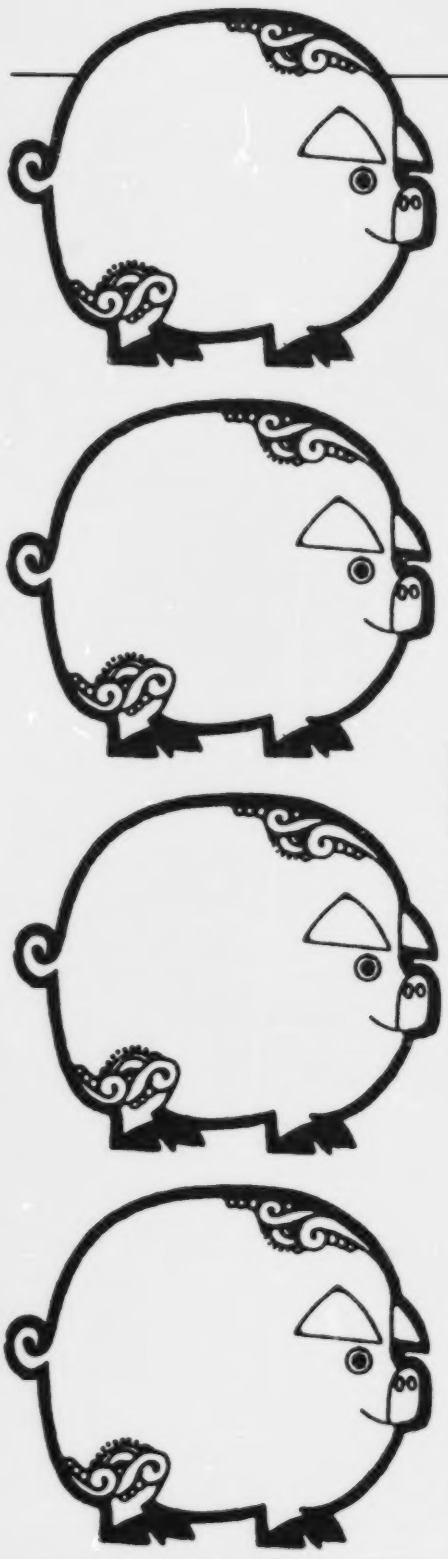

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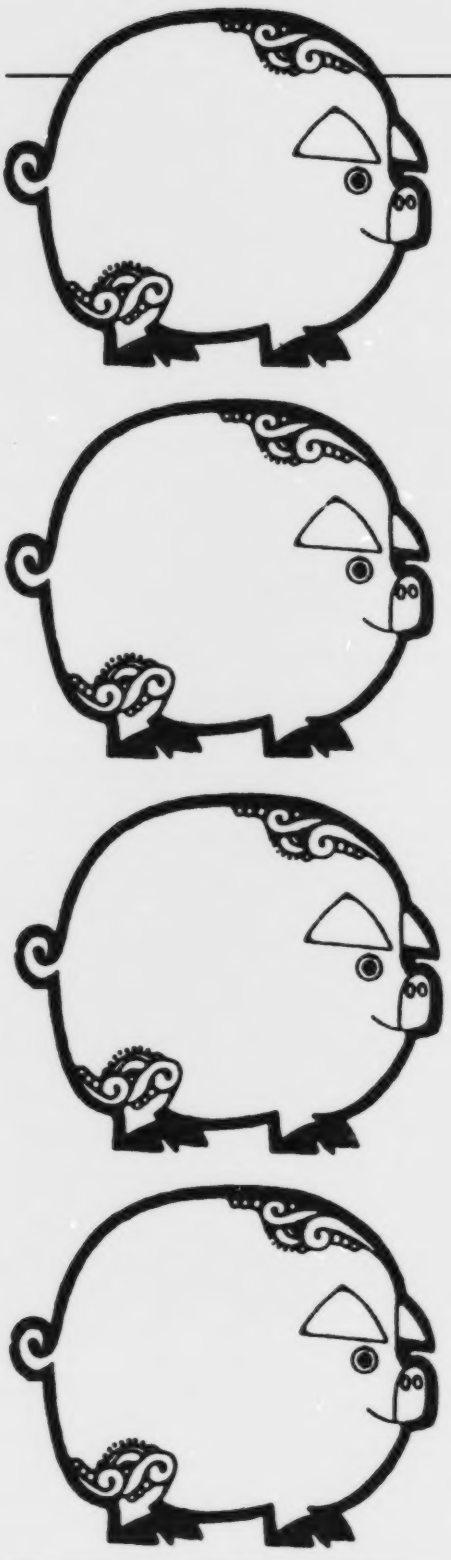

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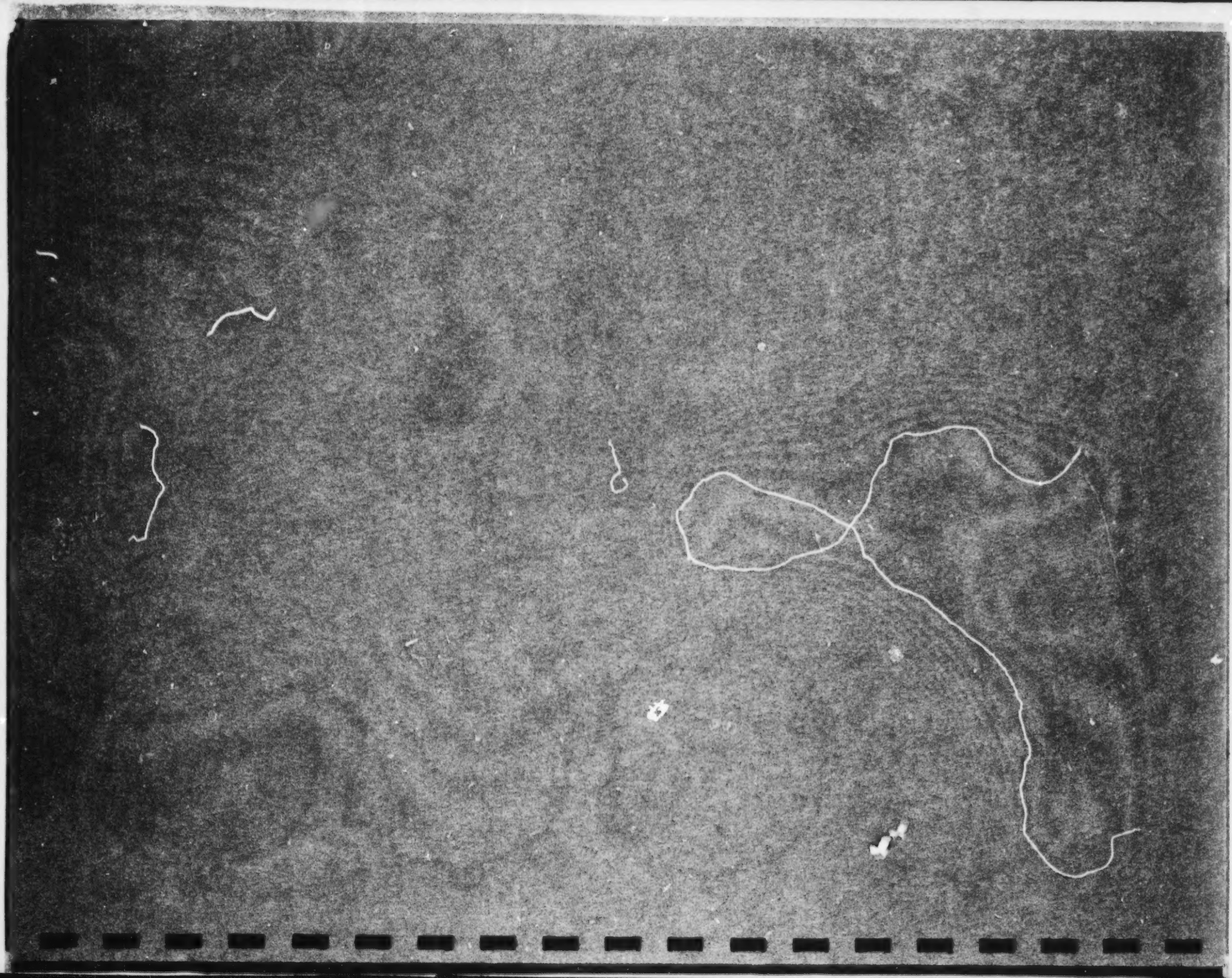

Getting The Most From Your Records — Manual and Computer Systems

Clarence Froese, Swine Program Specialist
Animal Industry Branch, Manitoba Agriculture

Most swine producers today collect some type of data pertaining to their herds, whether they be copies of marketing slips or detailed information on each animal in the breeding herd. Over the years, various devices such as cards, booklets and record-keeping binders have been developed and used for this purpose. What has generally been neglected however, are the procedures for dealing with the data after collection; or data analysis. Without this vital step, the whole process of keeping records becomes fruitless, since there is no point in recording information if it is not going to be used. Many producers who embark on a detailed recording program eventually become frustrated and give up for this very reason. "What is the purpose of recording this information when I'm not using it?" they ask. This question represents the essence of what is wrong with our approach to record keeping. Rather than collecting information and then attempting to glean something useful from it, we should be doing the exact opposite. One should first identify the most important indicators of the operation's production efficiency, and then proceed to collect only those data which are necessary for the calculation of such indicators.

Calculating The Important Indicators

The overall production efficiency of the breeding herd is best expressed by the statistic, pigs weaned per female per year. As illustrated by Figure 1, this statistic can be envisioned as the product of a repeating production cycle. The annual output of this cycle depends entirely on the number of revolutions it makes and the number of pigs produced by each revolution. Another way of stating this is:

Ave. Pigs Weaned/Female/Year = Ave. No. Litters Weaned/Female/Year X Ave. Litter Size at Weaning

The two reproductive traits in the above formula consist of a number of individual components, as illustrated in Figure 2. Unsatisfactory performance in a main reproductive trait is caused by a weakness in one or more of its components. This concept is useful in tracing the cause (or causes) of low breeding herd productivity.

If average litters weaned per female per year and average litter size at weaning are not known, an accurate diagnosis of productivity problems is very difficult to make. In spite of the fact that many producers collect detailed information on individual sows and litters, few take the time to actually use these data to calculate the indicators of overall herd reproductive performance. In other words, we are often too busy looking at the trees to see the forest.

Figure 3 illustrates a simple chart that contains all the necessary information to calculate pigs weaned per sow per year, litters weaned per sow per year and litter size at weaning. Note that the only requirement for completing this form is the ability to count the number of animals in each category on the last day of each month. Individual sow identification is not required. This chart represents the first and most important step in record analysis.

If a further breakdown of the above three traits is required, a form similar to the one illustrated in Figure 4 can be adopted. This "daily diary" requires individual sow identification and a greater time investment in recording information on sow cards or pocket booklets. However, it will provide data for calculating all the components of the main reproductive traits, thereby pinpointing specific problems. Completion of the latter form may not be possible in some herds but there is no reason for any swine herd to be without the Figure 3 chart, which represents a good starting point.

An important consideration in calculating herd reproductive efficiency is the point at which gilts are included in the breeding herd inventory. They should be included as soon as they exceed market weight, since this indicates that they are being kept for breeding. Any system which does not count gilts until some later point (at breeding, for example) is inaccurate since it ignores the effects of an excessive non-productive gilt pool or gilt breeding difficulties. Table 1 gives a hypothetical example of how the reproductive efficiency measurements of a 100 sow herd are influenced by the point at which gilts are included in the inventory count. Know the details of how a measurement is calculated before drawing any conclusions or making comparisons.

The most important indicators of feeder barn efficiency are <u>feed conversion ratio</u> and <u>growth rate</u>. Most operations do not have the time or the necessary labor available to obtain these figures on all pigs in the barn. However, estimates of both can be obtained by the routine use of a weigh scale.

Feed conversion ratio (units of feed consumed per unit of liveweight gain) must be measured on a pen basis since there is no practical method to measure

individual feed intake. This makes it difficult to obtain an estimate for a sample pen of pigs since most producers regroup animals into different pens according to their sizes as they progress through the barn. One approach that can be taken is to identify a certain number of "monitoring" pens in each of three areas of the barn; starting (15-30 kg pigs), growing(30-60 kg pigs), and finishing (60-100 kg pigs). A pig group can then be weighed upon being put into the pen, and then again a few weeks later when some of the pigs are removed for regrouping. All feed given to the animals in the pen during this period is weighed and recorded on a chart hung over the pen, similar to the one shown in Figure 5. By employing this procedure in at least three separate areas of the barn, it is possible to pinpoint the stage(s) where problems like slow growth or feed wastage are occurring.

Growth rate or age at market weight is relatively easy to monitor. Piglets can be ear-notched with their birth dates and these can be read at the various stages to determine the animal's age for its weight. Again, weighing should be done at least three times from the starting to finishing phase. Feeder pig operators should urge their weanling suppliers to routinely ear-notch, since this is the cheapest, most effective method of tracing animal age.

Putting Figures Into Perspective

Figures presented in a complicated format on a piece of paper often fail to achieve the necessary impact. Furthermore, they tend to tell us what happened rather than what is happening now or going to happen.

A simple analysis method which provides an up-to-date evaluation of the herd's reproductive efficiency is the female-month system. Monthly totals for litters weaned, live piglets born, and pigs weaned are divided by the total numbers of females that were present in the breeding herd at the beginning of the month. The resulting figure, when multiplied by 12, will provide a crude estimate of the yearly level that can be expected for that trait. This concept is illustrated by the following example:

1. Total Pigs Weaned During December: 140
2. Total Females in Herd as of December 1: 100
3. Ave. Pigs Weaned/Female/Month: $140 \div 100 = 1.40$
4. Estimated Pigs Weaned/Female/Year: $1.40 \times 12 = 16.8$

If the weaning level achieved in December was maintained over the next 12 months, expected production would be 16.8 pigs weaned per female per year.

The same calculation procedure can be used to obtain litters weaned per female per month and piglets born alive per female per month.

Assigning target values to each of these traits puts monthly production into perspective and indicates if management adjustments are necessary. Common target figures based on annual production can be expressed in terms of the female-month system so that monthly production can be evaluated as being above, below, or on target. Target values for some reproductive traits are shown in Table 2.

A Picture Is Worth A Thousand Words

The information collected on a chart such as Figure 3 is all that is required to plot monthly production levels on a few graphs. Summarized information presented in graphical form is often more easily comprehended than a page of statistics. Graphs such as those shown in Figure 6 should be hung right in the barn where they can readily be studied by the operator.

Graph A in Figure 6 shows that the herd has achieved or exceeded the overall productivity target level in only one of the past six months. Continuation of such performance for the remaining months will result in failure to achieve the annual target.

Why is herd production below target? Graph B illustrates that the problem appears to be a monthly lack of a sufficient number of litters weaned for the total number of females in the breeding herd. Average litter size at weaning is not a problem, as shown in Graph C. Therefore, corrective action for this situation should emphasize obtaining more weaned litters, rather than increasing litter size at weaning. This probably means paying closer attention to breeding.

Failure to monitor breeding is one of the main causes of low productivity today. Great progress has been made in improving the environment and nutrition of young pigs, to the point where it is no longer difficult to obtain an average of 8 or 8.5 pigs weaned per litter. However, the whole production process begins with successful conception. Most importantly one must ensure that enough females conceive each month to maximize the use of facilities.

A graph such as the one shown in Figure 7 can be helpful in this regard. This can be put on the wall in the breeding area. To construct this graph, first determine the number of conceptions required per month for the facilities available. For example, a 100 sow herd aiming at 2.20 litters weaned per female per year will require 18 successful conceptions per month $\left(\frac{100 \times 2.2}{12} = 18\right)$. This becomes the

target line on the graph. Then, at the end of every month, plot the number of females bred, by means of a bar. After heat checking or pregnancy testing these females, indicate the number of successful monthly conceptions by shading the appropriate area of the bar (see Figure 7). Months suffering from insufficient total breedings or poor conception rates are easily identified.

Graphs can also be helpful in the feeder barn. Target values for weights, ages and daily feed consumption can be assigned to each of the different phases of growth. Suggested target values are shown in Table 3. By plotting the attained weights of identified pigs on a graph such as the one shown in Figure 8, it is possible to isolate the stages where poor performance is occurring. Figure 8 shows that growth rates for the example herd suffer during the starting (56-80 day) phase, advance on target during the growing phase (80-120 days) but drop off again during the finishing period (120-165 days).

Various devices which aid in the planning of work and production schedules are available commercially. Included in this group are wheels, charts, carousels and trays. These systems all operate on a calendar concept, reminding the producer on a daily basis to perform various tasks. They also identify individual females which are due for farrowing, weaning, breeding, etc. The carousel and tray devices offer the advantage of convenient information storage within the device itself, saving the operator from having to search for the animal's performance data from another source. The wheel and chart devices, however, make it easier to determine the overall herd's status (numbers to farrow, number of repeat breedings, etc.) at a glance. Any of these systems can greatly streamline the record keeping process, but none replaces the need for routine calculation of the important herd efficiency factors.

What About Computers?

With the development of the microchip and other advanced technologies, computers have suddenly become affordable for many small businesses. Some large swine operations have been using micro or minicomputers for record keeping for a number of years. Many more are now investigating this possibility. This trend does not necessarily mean that every swine operation will have, or even should have, a computer system in the next few years. However, it would be a mistake to <u>not consider</u> a computer when planning for the future.

Computers are little more than sophisticated calculators which can store data and recall them almost instantaneously. They can perform various mathematical operations and sift through or sort immense files of information

at extraordinary speed. Furthermore, they will perform these tasks very accurately and work for long periods of time without stopping.

Just like a calculator, however, a computer cannot do anything unless it receives accurate data and is told what to do with those data. A computer cannot give advice, for example, on how to set up a record keeping and accounting system suitable for an individual operation. It can also not recognize instructions given to it in everyday common language. It is for these reasons that many swine producers are not in a position to fully utilize the capabilities of a computer at the present time.

Is a Computer System For You?

The purchase of a computer must be viewed in the same light as the purchase of any other piece of farm machinery. A number of questions must be asked and answered before proceeding. If purchased without sufficient justification, a computer system is little more than a very expensive "toy".

An evaluation of your present records' collection and analysis system is the first step when considering a computer. The data that are presently collected must be both complete and accurate. A computer cannot "guess" missing information such as a breeding date, nor can it detect an error due to careless recording. Erroneous data will produce erroneous summaries and only confirm the old adage "Garbage in - Garbage Out."

If the present records are not being routinely analyzed for decision-making, it is improbable that a computer will stimulate this process. It is important to remember that a computer will not reduce record-keeping and management time. It will however, improve the quality of information available, thereby improving the decision-making (management) process. If you feel you can't afford the time to collect and analyze records now, you probably won't with a computer system either.

A good perspective on the capability of various machines is provided by Figure 9. This figure can also be used to evaluate one's requirement for a computer. Many swine producers today would be well-advised to become better acquainted with the pencil and calculator before proceeding to the micro or minicomputer stage.

Types of Computer Systems

All computer systems consist of two main components. Hardware, as the term implies, refers to the actual computer equipment - the central processor, disk

storage device, printer, etc. Software refers to the set of detailed instructions which tell the computer how to process the data. These instructions must be written in a form which will allow communication with the electronic switching circuitry of the machine. The rapid development of affordable hardware that is applicable to swine operations has far outstripped the development of suitable software. This lack of software is the major difficulty facing a swine producer who wishes to establish a computer system at this time.

A comparison of the various types of computers that are available is shown in Table 4. The types most commonly used by swine producers are the programmable calculator, microcomputer, and the main-frame computer. The former two types are self-contained, on-farm units while the latter is accessed through a terminal, which may also be placed on the farm.

Programmable calculators, like any computer, can greatly increase the speed of calculating a series of mathematical steps. After the calculator is programmed, the operator simply asks for the answer instead of entering each mathematical step as it occurs in the calculation procedure. Programs are available in various forms such as modules and magnetic cards, and these are simply inserted in the calculator when required.

The disadvantage of programmable calculators is that they are quite limited in their capacity to store information. Historical data such as individual sow and herd production histories require more storage capacity than that offered by this type of machine. Its main application lies in providing quick answers to problems based on limited or summarized data, and it can be very useful in making short-term management decisions.

Micro and minicomputers are very similar in appearance to one another but differ in their storage capacities, as illustrated in Table 4. Most micro computers have the capability to handle any detailed swine recording program, providing information for long-term management strategy, as well as immediate decisions. Programs and data are commonly stored on discs or cassette tapes. One character of stored information (number or letter) is termed a "byte", and a typical five and one-quarter inch diameter floppy disc can store 140,000 to 500,000 bytes of information. A general rule that has been suggested when sizing computer requirements is to allow 250 to 500 bytes of storage for each sow for which you wish to maintain a record. This will allow storage on roughly seven litters per sow. A typical disc could thus store information on at least 250 sows.

Micro computers also offer the advantage of better information presentation than a programmable calculator. Printers or screens can display information that ranges from 40 to 80 columns in width and 12 to 30 lines in depth, compared with the single number display of a calculator.

The main disadvantage of micro or mini-computers for swine operations continues to be a lack of suitable, high-quality programs. Few commercially available programs offer the capability or flexibility to evaluate and summarize herd or individual animal performance by numerous criteria, which is the real advantage of a microcomputer over a calculator. Better-quality programs are also quite expensive, costing two to eight times more than the equipment on which they run.

Main-frame computers offer almost unlimited storage capacity and are too expensive for any small business. However, terminals which connect with these computers through a telephone hook-up can be purchased at affordable prices. This provides a method whereby producers can gain access to the greater variety and better quality programs often available on a main-frame computer. Operating costs can be substantial for this system since the operator is charged for telephone and computer usage time.

Evaluating Software

The extra costs involved in purchasing a complete computer system can only be justified if the system will provide information not readily obtained with a pencil and calculator. This means that software is the key element of the system. Most experts agree that producers establishing a computerized recording system should spend 90 percent of their shopping time evaluating software, with the remainder spent on obtaining the appropriate hardware. Most producers do not possess the necessary expertise to do their own programming and so must hire a programmer to write the software for their operation. With programmers often charging $40 per hour, this option quickly becomes unaffordable. The two remaining options are to locate a commercial outlet selling specialized swine record-keeping software, or to use the software on a main-frame computer via a terminal or mail-in service.

A number of factors should be considered in evaluating record-keeping software.

a) Completeness - Does the program apply to the feeder as well as to the farrowing portion of the enterprise? There are very few programs which will provide summaries for post weaning growth rate and feed conversion ratio. Yet these are critical factors in swine production.

The program should streamline inventory control so that the status of any animal or group at any time can be readily obtained. From this, it should be possible to obtain production schedules for farrowing, weanings, breedings, heat checks, and other necessary management procedures. A complete history of every animal in the breeding herd should also be available with minimal effort.

An in-depth analysis of historical data in a variety of ways should be possible, and at the operator's fingertips for routine usage. Some of the analyses methods might be as follows:

(i) Rolling historical herd averages for various traits to allow comparison of past and present performance.

(ii) A herd profile which indicates the present composition of the herd according to female parity.

(iii) Summarization of data according to individual rooms or areas within the barn.

(iv) Ranking of sows based on any single trait or combination of traits.

(v) Summaries of individual boar reproductive performance according to farrowing rate, litter size and mating frequency.

The program should also possess the capability of forecasting production output, which serves as a basis for determining cash flow. This particular aspect must be flexible so that the effects of a change in efficiency on production can be readily examined.

Expansion of the program to include additional production records, as well as complete financial records should be easily achieved. Many swine record-keeping programs now include sow productivity indexes to evaluate a female's overall reproductive performance. Common computerized accounting systems such as the "Visicalc" spreadsheet should be easy to annex to the herd production summaries.

b) Simplicity of Interpretation - As with manual systems, figures generated by a computer will not be used if they are difficult to place in perspective. Some systems are capable of generating information in graphical form, which often simplifies interpretation. Excessive paper containing lines of meaningless figures interspersed with valuable information will only lead to frustration. Output reports should contain only the required information in a well-labelled, easily read format.

c) User Friendliness - This term refers to the ease with which a computer can be instructed to perform its programmed duties. Instructions can be entered by a "menu" system, which poses a series of questions to the operator before

processing the data. The operator's answers to these questions provide the necessary instructions to the computer. Although this system requires more time to obtain results, it is easier to operate - particularly for the novice. It also ensures that the instructions are entered properly.

The best advice that can be given to producers who are considering a computerized system is to communicate with other swine producers who already have one. Various informal producer groups interested in on-farm agricultural computing have been organized in the U.S., with another recently being organized in Ontario. Members of such groups would undoubtedly provide excellent advice and ideas.

Summary

Many swine producers fail to identify objectives when establishing a record-keeping program. This results in an accumulation of data which are not utilized to their full potential. Some simple, quick manipulations using only a pencil and calculator can provide valuable insights to herd performance levels and problems. Computers can further refine herd data analyses but only if a commitment is made to routinely collecting complete and accurate information. Most swine producers today should concentrate their efforts on establishing a routine manual record analysis system before graduating to the computer stage.

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Table 1. Influence of inclusion point of gilts[1] in breeding herd inventory on reproductive efficiency measurements in a 100 sow herd.

Measurement	Gilts Included in Inventory at: Market Weight	Breeding[2]	Farrowing
Ave. Pigs Weaned/Female/Year	16.0	16.7	18.9
Ave. Litters Weaned/Female/Year	2.00	2.09	2.36

[1]Assumes that 48 gilts are selected annually and 36 of these conceive and stay in the herd.

[2]Assumes that gilts are bred an average of 30 days after attaining market weight.

Table 2. Suggested target values for some reproductive traits.

Trait	Target Value Per Female Per Year	Per Female Per Month
Ave. no. pigs weaned	18.0	1.50
Ave. no. litters weaned	2.20	0.18
Ave. no. live pigs born	21.0	1.75

Table 3. Suggested target values for post-weaning performance[1] at various points of growth.

Pig Weight (live) kg	Pig Weight (live) lb.	Age (days)	Daily Feed Intake[2] kg	Daily Feed Intake[2] lb	Feed Conversion Ratio (units/feed/unit liveweight gain)
5	11	21	0.2	0.5	1.25
18	40	56	0.9	2.0	2.00
30	66	77	1.7	3.7	2.80
60	132	120	2.5	5.5	3.30
100	220	165	3.4	7.5	3.80

[1]Assumes disease-free pigs housed in confinement and self-fed recommended rations.

[2]Air dry diet (i.e., 90% dry matter)

Table 4. Varying sizes of computers.

Type	Relative Cost[1]	Memory Capacity
Programmable Calculator	$100-$1,000	Smallest
Microcomputer	$1,000-$10,000	↓
Minicomputer	$10,000-$1,000,000	↓
Main-Frame Computer	$1,000,000 & up	Largest

[1]Figures show general relationships. Actual prices vary widely.
P. Spike, Proceedings of Pork Producers Day, Iowa State University, 1981.

Figure 1. Pigs Weaned/Female/Year

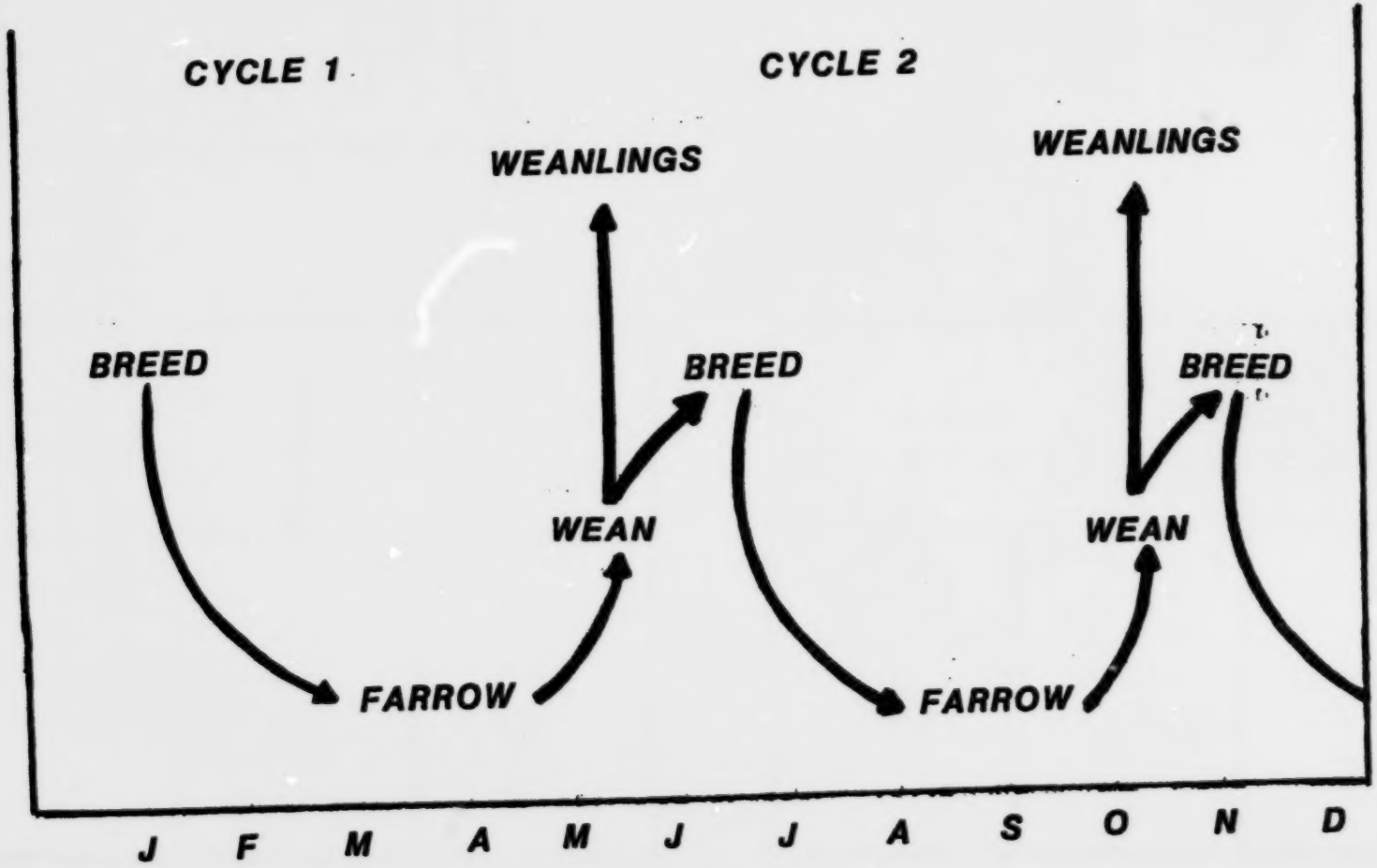


Figure 2. Components of Reproductive Efficiency

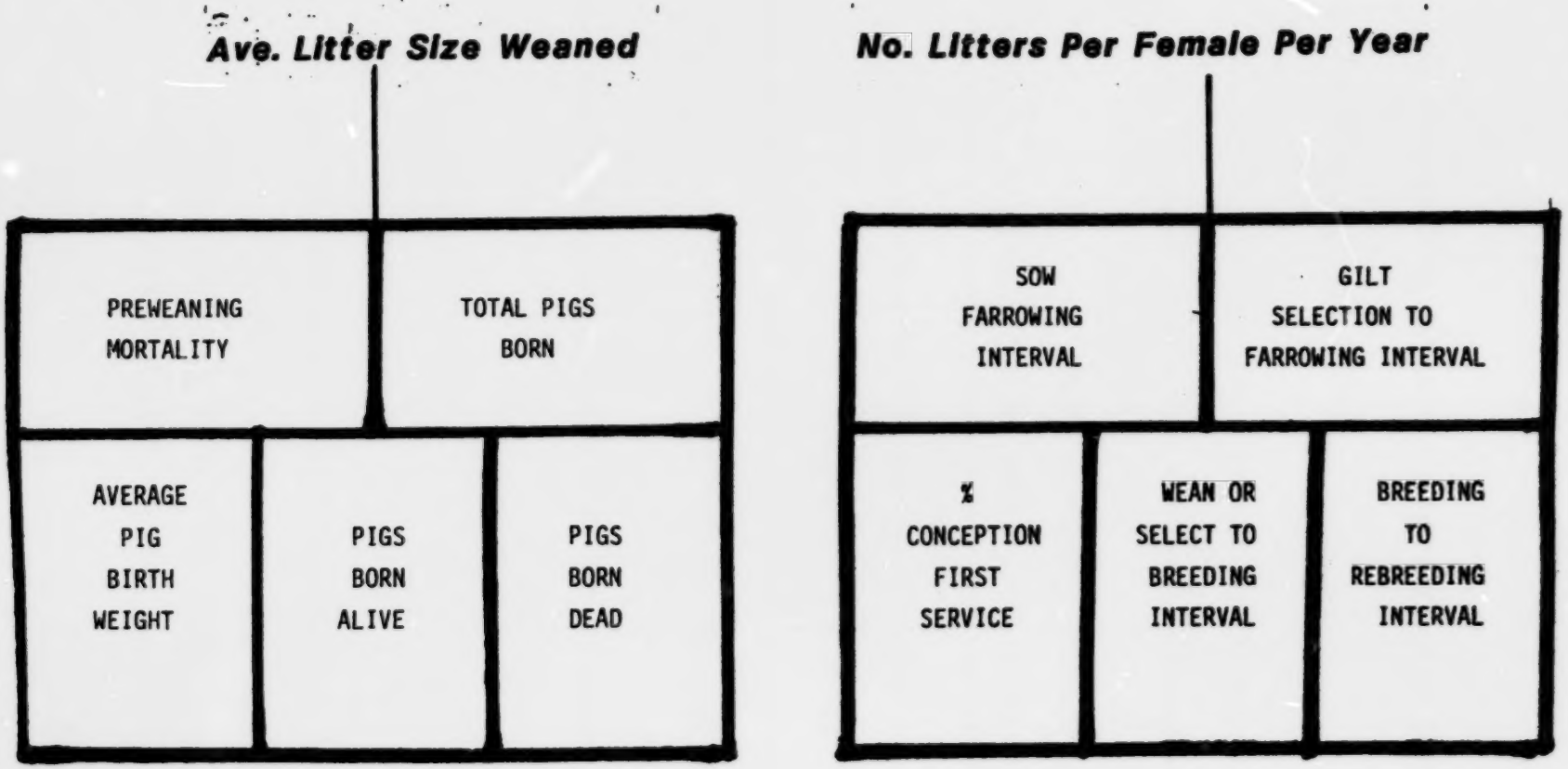


Figure 3. Monthly Breeding Stock and Production Inventory Record [1]

Column	1	2	3	4	5	6
MONTH	No. Sows[2]	No. Gilts[3]	No. Litters	No.Live Pigs Born	No. Litters Weaned	No.Pigs Weaned
JAN.						
FEB.						
DEC.						
Total						

[1]Enter last day of each month.

[2]Replacements are gilts until they wean first litter.

[3]Gilts are counted when selected from finishing barn.

Complete the information below at the end of the year or 12 month period.

A. (Col. 1 _____ + Col. 2 _____) ÷ 12 = average sow herd size.

B. Col. 5 total _____ ÷ average sow herd size = litters/sow/year _____.

C. Col. 6 total _____ ÷ average sow herd size = pigs/sow/year _____.

Iowa State University

HERD _____

MONTH _____

Figure 4. Breeding Herd Activity Sheet

SOW I.D.		GILT ADDITION	BREEDING DATA		FARROWING DATA				WEANING DATA			SOW DISPOSAL		COMMENTS
							No. Born Dead							
Tag No.	Retag No.	Date Brought In (M/D)	Date Bred (M/D)	Boar No.	Date (M/D)	No. Born Alive	Normal	Mummified	Date (M/D)	No. Weaned	Total Litter Wt. (kg)	Date Culled (M/D)	Reason (Code)	

DEATH LOSSES (NO.) Weaning to 30 kg _____ 30 kg to market _____

Sow Disposal Codes: 1. Anestrous; 2. Repeat Breeding; 3. Non-Pregnant; 4. Low Litter Size; 5. Lameness, leg injury; 6.Abscesses 7. Old Age; 8. Abortion; 9. Low Milk Production; 10. Mastitis; 11. Prolapse Uterus; 12. Other (Specify)

Abortions: Please record date under Farrowing Date column, and write "Aborted" in No. Alive column.

Figure 5. Weight Gain and Feed Consumption Record

PEN NO. _____ LITTER NO.(S) _____

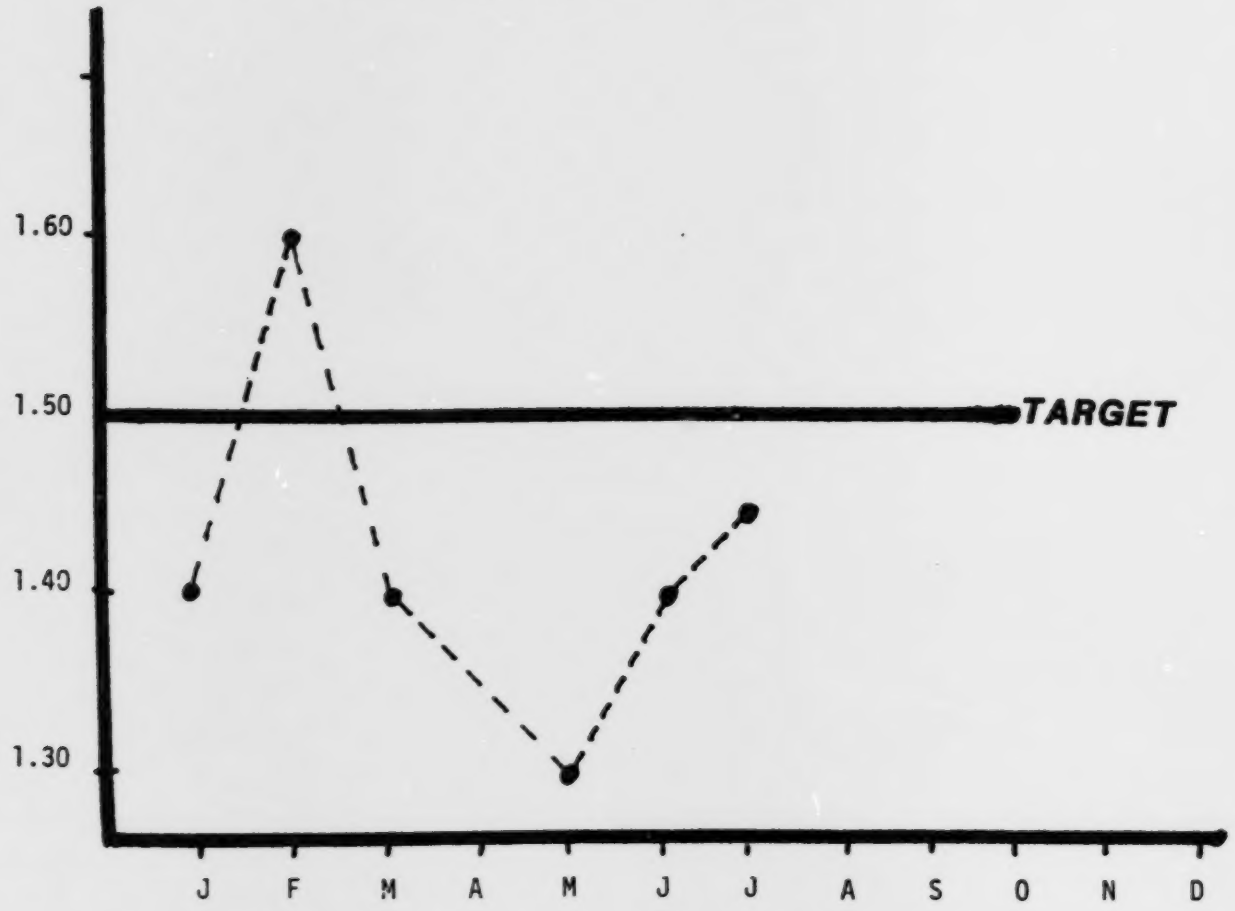
IN		OUT	
Date	_____	Date	_____
Ave. Weight	_____	Ave. Weight	_____
Ave. Age	_____	Ave. Age	_____

FEED CONSUMPTION RECORD

Date	Feed Added	Feed Weighed Back	Net Feed Consumption
Total			

Figure 6. Graphing Reproductive Efficiency

GRAPH A. PIGS WEANED/FEMALE/MONTH



	J	F	M	A	M	J	J	A	S	O	N	D
Pigs Weaned	146	163	140	133	137	145						
Sows & Gilts	104	102	100	102	98	100						

Figure 6. Graphing Reproductive Efficiency

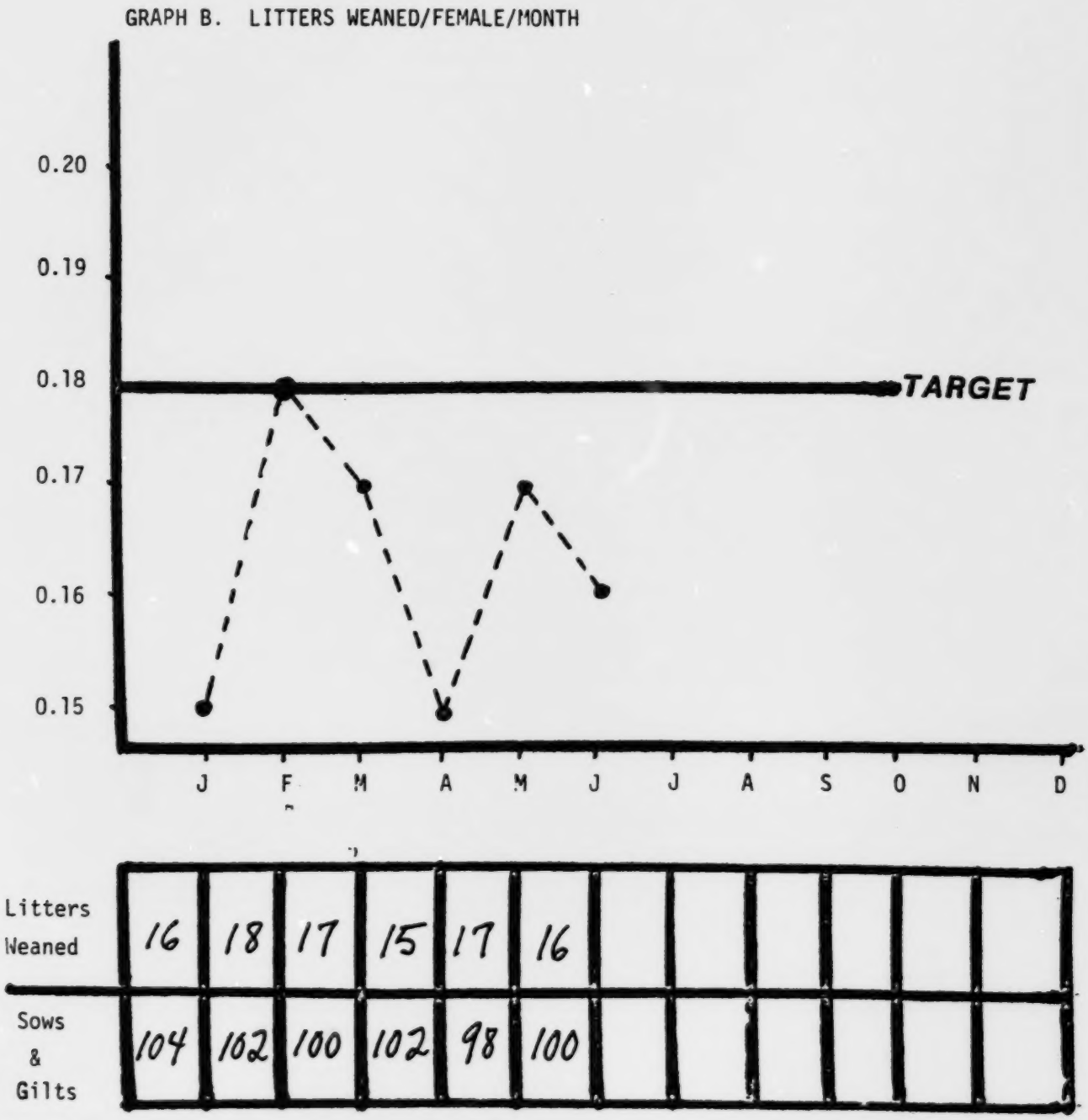
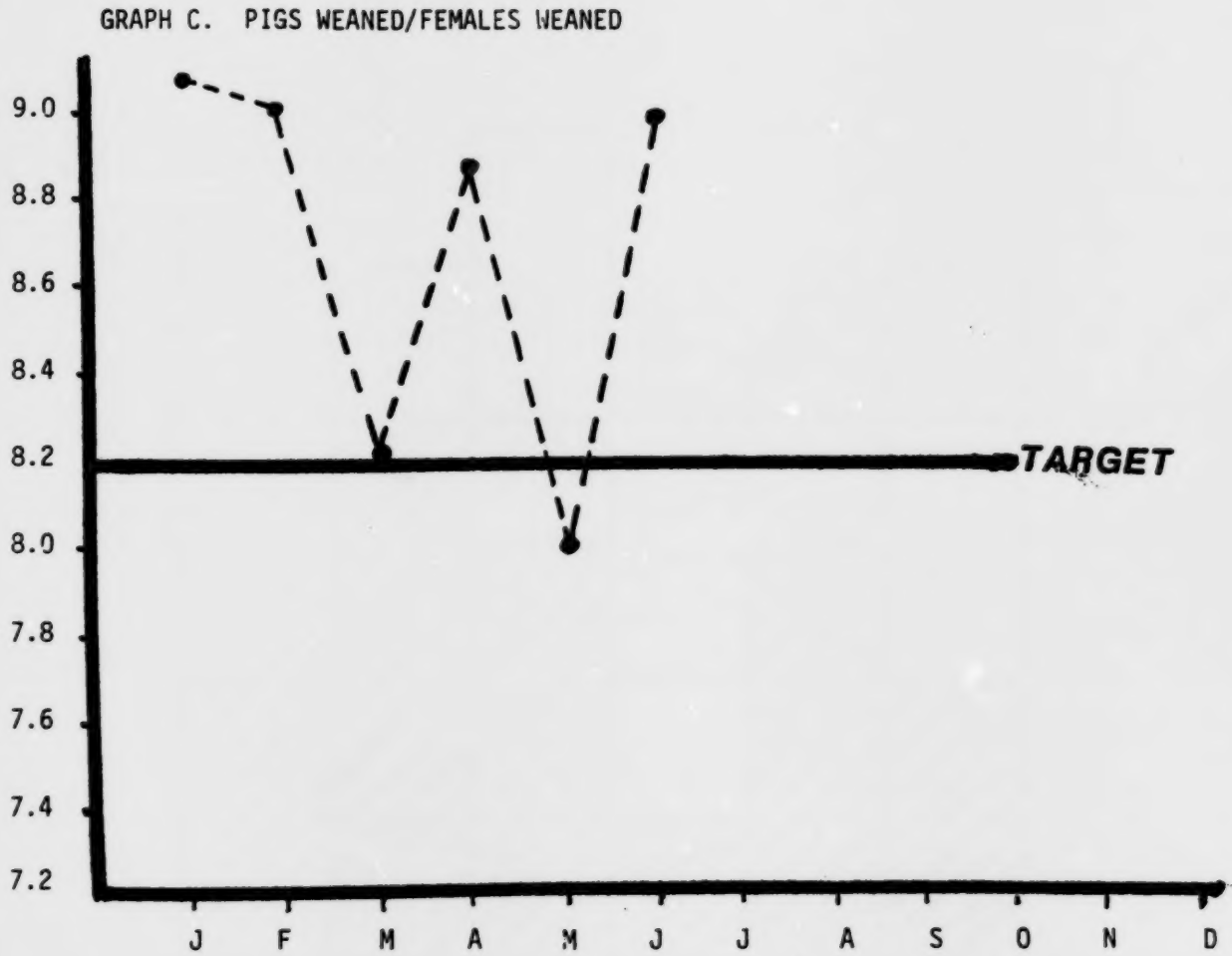
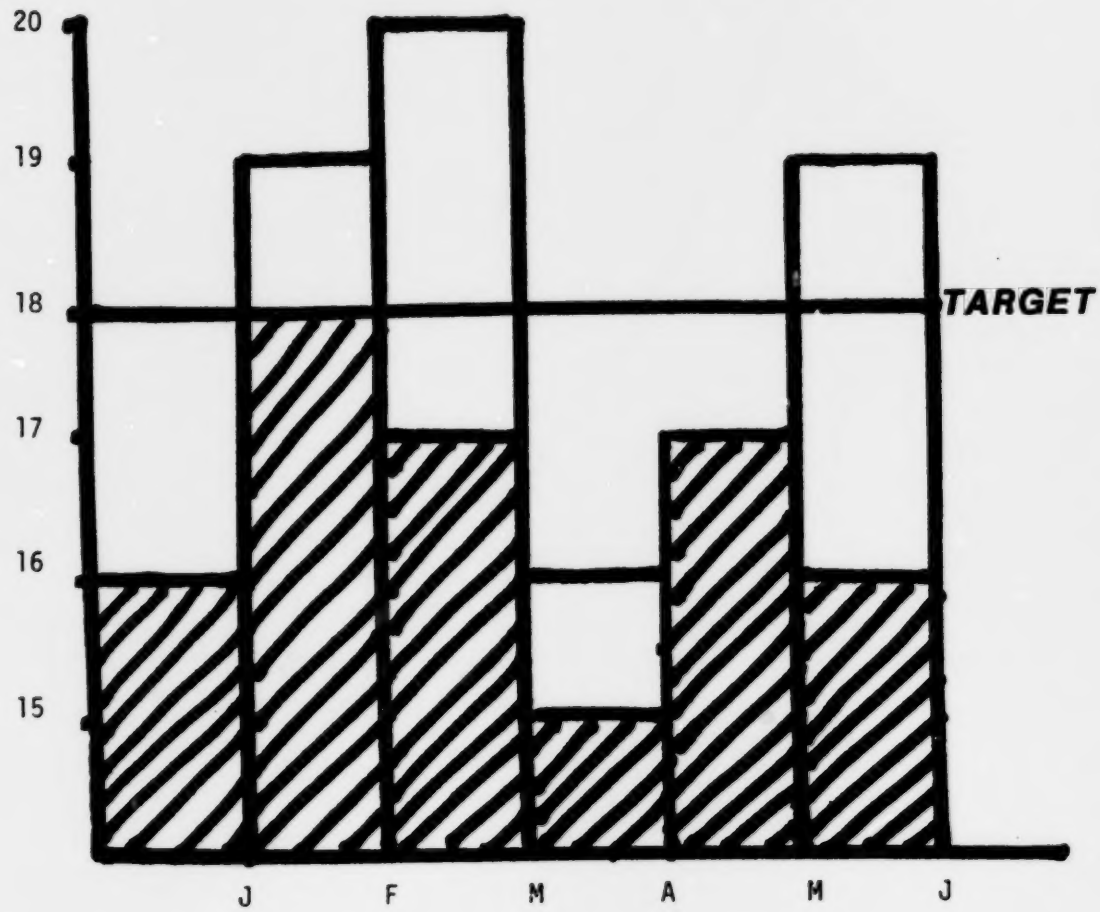


Figure 6. Graphing Reproductive Efficiency



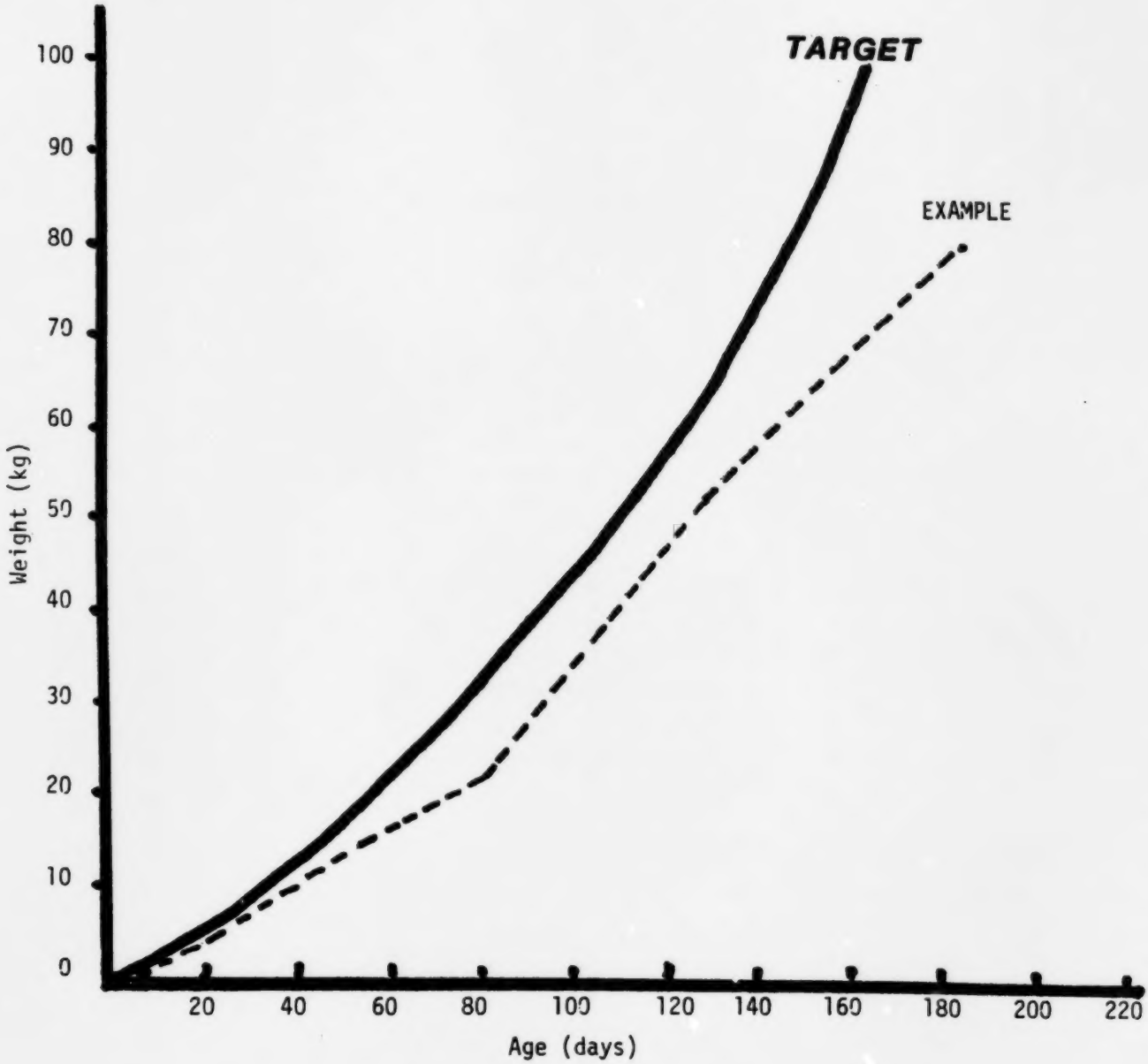
	J	F	M	A	M	J	J	A	S	O	N	D
Litters Weaned	146	163	140	133	137	145						
Females Weaned	16	18	17	15	17	16						

Figure 7. Monthly Breedings and Conceptions



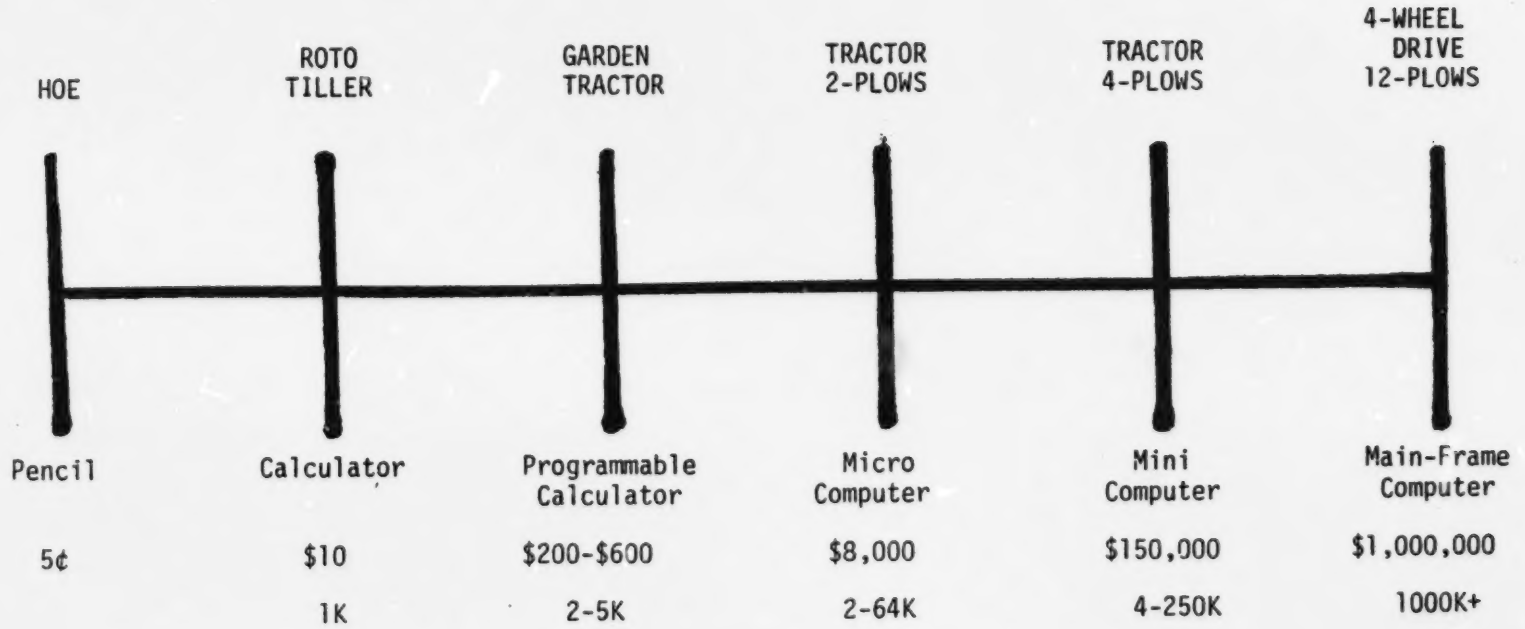
Females Bred	18	19	20	16	17	19	
No. Pregnant (30 days)	16	18	17	15	17	16	

Figure 8. Target Growth Pattern - Birth to Market



Age (days)	21	56	80		120			180		
Weight (kg)	4	15	22		52			82		

Figure 9. Capacity and Costs of Various Computers in Perspective



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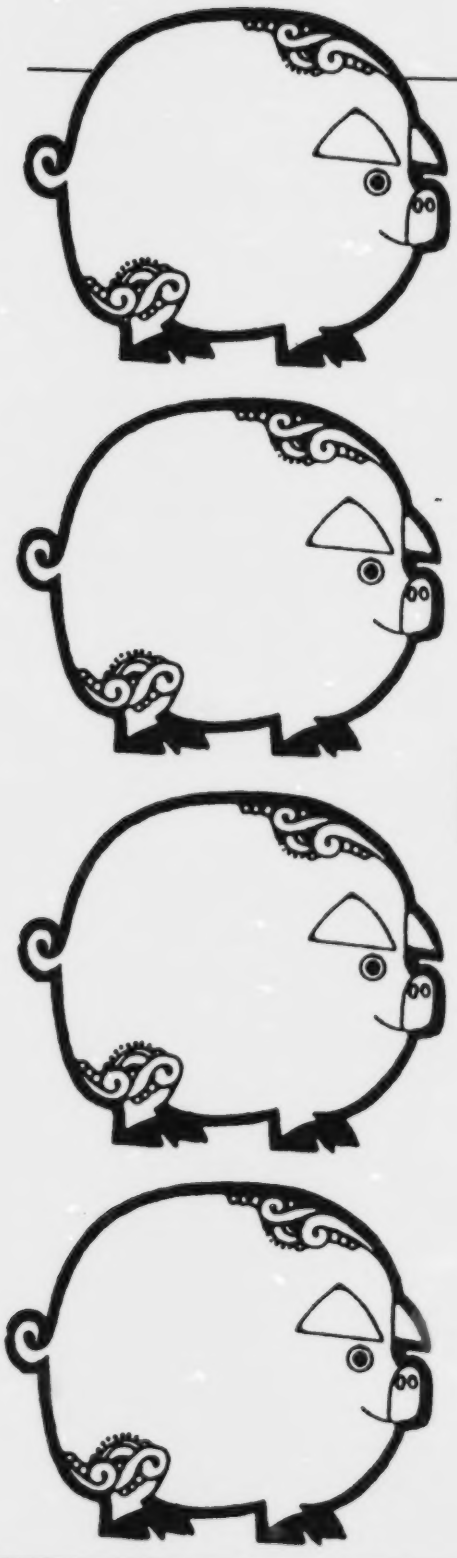
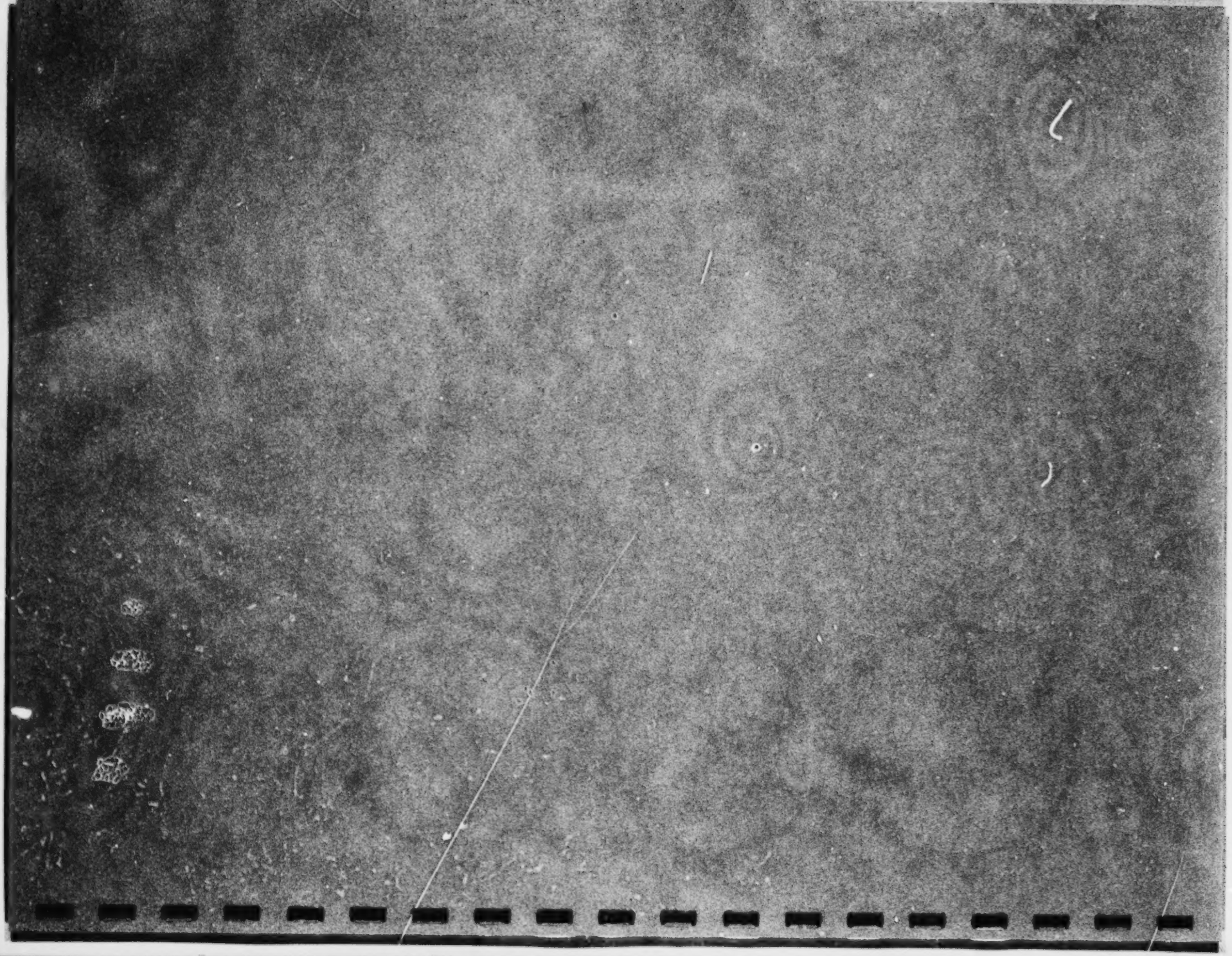


Hog Day '82



Nutrition of the Sow During Gestation, Lactation and Wean-to-Rebreeding

A. H. Jensen[1]

Reproductive efficiency, however expressed, is essential for profit realization in the high-risk business enterprise of swine production. Many factors - breeding, feeding, management, environment, health - affect the efficiency realized. We will in this discussion consider (1) dietary energy, protein, certain minerals and vitamins; (2) certain mold toxicities; and (3) management practices that currently are of special interest to swine producers.

ENERGY AND PROTEIN

Energy and protein represent the major components of swine diets. And in many experiments designed to evaluate the effects from feeding different levels of feed during gestation it is difficult to separate energy effects from protein effects.

GESTATION

Levels of gestation feed varying from .9 to 3.0 kg per gilt per day significantly affected gilt weight gain and pig birth weight (Baker et al., 1969). The results suggested that for first-litter females 1.9 kg of feed per day, about 6000 kcal of metabolizable energy (ME), was adequate in a confinement environment when ambient temperature did not go below 10°C. Frobish et al. (1973) reported that numbers of total and live pigs farrowed per litter were similar from sows fed 3000 to 6000 kcal of ME per day, but 7500 kcal of ME per day reduced performance. Birth weights and weaning weights increased linearly as energy intake increased. Other results supported these findings (Libal and Wahlstrom, 1977). In a summary of data from experiments in France involving 5000 sows, Henry and Etienne (cited by Cromwell, 1980) estimated that gestation weight gain of sows and gilts increased about 13 kg, and birth weight of pigs from gilts and from sows increased about 23 and 55 grams, respectively, with each additional 1500 kcal of digestible energy (DE) per day (table 1).

Additional feed intake during the last 30 days of gestation may seem desirable since about one-half of the fetal growth occurs during the last month of gestation. However, Cromwell (1980) reported that when total gestation gains were similar, a constant amount per day (1.8 kg in summer, 2.27 kg in winter) produced the same results as daily levels of 1.4 kg in summer or 1.8 kg in winter during the first 90 days, and 3.27 kg in summer or 4.1 kg in winter during the last 23 days of gestation. Pond et al. (1981) reported that doubling the energy (adding cornstarch) of a 14% corn-soybean meal gestation diet from day 100 to parturition had no significant effect on piglet birth or 28-day weights or on survival rate.

Moser and Lewis (1980) reviewed the published information relative to the effects from adding fat to diets. They concluded that adding fat to the diet during the last few days of gestation increased fat content of the sow's colostrum and milk. Survival of small (less than 0.9 kg at birth) pigs in some cases increased. Pig body fat and glycogen stores were frequently increased but

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not significantly. Coffey et al. (1982) found that adding animal fat to the sow's diet during the last trimester of gestation increased ($P<.05$) piglet blood glucose at birth and after a 48-hour fast.

However, in a study including three successive parities, Pollmann et al. (1980) found no effects of added dietary tallow on pig survival. There was, however, evidence of increased litter size at 14 days when alfalfa meal was included in the diet (table 2).

The dietary levels of amino acids required during gestation are relatively low. The pregnant sow is very efficient in utilization of dietary amino acids, but a deficiency of an essential amino acid does reduce performance. Milo and milo-plus-lysine as sole sources of amino acids were evaluated for gestating gilts (Jensen, A. H., 1967, unpublished data). Compared to a 12% protein corn-soybean meal diet, gestation gain of gilts on the milo diets was lower ($P<.05$), but average number of pigs per litter farrowed and average weights of pigs at birth were not significantly different (table 3). Baker et al. (1970a) reported that number and weight of pigs farrowed by gilts were similar when either regular corn, opaque-2 corn, or 12, 16 or 20% protein corn-soybean meal diets were fed (table 4). Also, gilts that received only corn during the first two-thirds of the gestation period had lower gains, but bore similar sizes and weights of litters (Baker et al., 1970b). Second-litter sows were less affected by the all-corn diet than were gilts.

LACTATION

The energy needs of the sow are much greater for lactation than for gestation. Some of the more extensive studies have been reported by O'Grady et al. (1973; 1975). They found that the yield and composition of milk and growth of litters were not influenced by dietary energy intake in the first lactation, but they were depressed by low energy intakes in the second and third lactations. Thus, adequate energy is essential for maintenance of high milk yield and nursing pig growth over several parities.

Libal and Wahlstrom (1975) reported that number of pigs weaned and average weaning weight were similar when the sows were fed either ad libitum or .45 kg per day per nursing pig during a 20-day lactation period. However, the ad libitum-fed sows consumed more feed per pig nursed and maintained body weight. Limit-fed sows lost 12.9 kg. Reese et al. (1982) reported that inadequate metabolizable energy intake during lactation resulted in greater sow body weight loss and in reduced backfat thickness. Piglet weight at weaning was also lower, but litter size was not significantly affected (table 5).

Stahly et al. (1980) fed sows ad libitum a corn-soybean diet with 10% of either fat or starch. The addition of fat to the lactation diet of the sow increased ($P<.05$) the sow's daily metabolizable energy intake and milk fat content. The fatty acid composition of sow milk and pig adipose tissue at weaning reflected that of the fatty acid profile of the sow's diet. However, the dietary fat source did not influence the growth rate or survival of pigs from birth to weaning or from weaning to market weight (table 6).

Mahan et al. (1971) demonstrated that a 16% corn-soybean meal diet fed to first-litter sows resulted in maximum litter weight gains when litter size was not greater than eight. With second-litter sows, ten pigs per litter, litter gains were greater when an 18% rather than a 16% crude protein diet was fed.

These workers also reported (1971a) that in first-litter sows milk production and its nitrogen content were not influenced by dietary protein level or opaque-2 corn from 14 to 19 days postpartum, but they were reduced from 22 to 27 days in sows fed a 10% protein or opaque-2 corn diet.

First- and second-litter sows fed 10% protein or opaque-2 corn were in negative nitrogen balance during both trials. First-litter sows fed 14% protein were in negative nitrogen balance during the first trial (14 to 19 days) and in nitrogen equilibrium from 22 to 27 days postpartum. An 18% protein diet supported positive nitrogen balance values in both trials for first- and second-litter sows. They further noted (1971b) that milk production was reduced ($P<.05$) as dietary protein level was reduced from 18 to 10 percent.

More recent research has been directed toward determining the dietary requirement of the amino acids lysine, tryptophan, threonine, isoleucine, leucine, and valine (Lewis and Speer, 1973, 1974, 1975; Haught and Speer, 1977; Rousselow et al., 1979; Rousselow and Speer, 1980).

GESTATION-LACTATION

Underfeeding during gestation will result in lower birth and weaning weights of the offspring (Lodge et al., 1966; O'Grady, 1967; Baker et al., 1969). In general, considering inadequate to superadequate energy intakes during gestation, there is an inverse relationship between gestation gain and lactation gain. It appears that in a comfortable environment, gestation gains (maternal gains) of 35 kg for gilts and 20 kg for sows should be adequate. Obviously, the calorie density and nutritional adequacy of the diet and the management environment will affect the level of daily feed to produce these gains.

Protein nutrition during gestation affects lactation and progeny performance. Litters from gilts and sows fed an all-corn diet during gestation had slower growth rates during a 21-day lactation period than did pigs from dams fed a 16% protein corn-soybean meal diet during gestation (Baker et al., 1970). Gestation-lactation dietary protein level sequences of 9/18, 12/16 or 14/14% for three parities resulted in comparable overall performance, although production was somewhat less from the 9/18% group (Mahan, 1979). Frobish (1978) summarized an extensive cooperative study in which 9 or 15% dietary protein levels were fed during gestation, and either 12, 16 or 20% fed during lactation. Sows fed the 9% diet tended to farrow fewer pigs than those fed 15%. Lactation performance was increased between 12 and 16% protein, but there was no further advantage for 20% protein diets (table 7).

Greenhalph et al. (1980) fed barley-based diets with 9 or 11% protein during gestation and 13, 15, 17 and 19% levels during lactation. They concluded that the 11/15% sequence gave the best results.

CALCIUM AND PHOSPHORUS

The recommendations for either dietary levels or absolute daily intakes of calcium and phosphorus vary appreciably. Dietary levels of .75% calcium and .60% phosphorus have apparently been adequate during gestation when sows received about 2 kg of diet per day and have been in a comfortable environment. Lactation diet levels of .75% calcium and .50% phosphorus have also been widely used (NRC, 1979). However, Nimmo et al. (1981a,b) and Mahan and Fetter (1982) emphasized the need to consider the total cycle of growth, and several gestation

and lactation periods as criteria for evaluation. They concluded that the NRC recommended levels were inadequate for first-litter sows when physical strength (long-term productivity in confinement) and total reproductivity were considered.

BIOTIN

The value of supplemental biotin in diets for breeding swine has been a point of controversy. With corn-soybean meal diets added biotin has not proven consistently nutritionally beneficial. When diets have been based primarily on wheat or barley some apparent benefits have been reported (Grandhi and Strain, 1980; Penny et al., 1981).

MOLDY FEED

Certain mold-produced toxins on feedstuffs fed to sows can cause depressed reproductive performance (Miller et al., 1973; Sharma et al., 1974). Recently, Young et al. (1982) reported that corn contaminated naturally or by inoculation with zearalenone (a toxin produced by Fusarium roseum) in diets for gestating swine reduced total reproductive performance, fewer sows completed two parities and fewer piglets were weaned per litter. Etienne and Jemmali (1982) observed similar adverse effects when zearalenone-contaminated feed was fed during gestation. They did not, however, detect any mycotoxin residues in the gilts or the fetal tissues. James and Smith (1982) found evidence that dietary alfalfa may slightly modify the toxic effects of zearalenone added to diets fed to young (8 to 11 kg in weight) gilts.

MANAGEMENT AND FEEDING PRACTICES

INTERVAL FEEDING DURING GESTATION

Individual daily feeding provides greatest control of a feeding program, but can be labor intensive. Several researchers have evaluated interval feeding, every-other-day or every-third-day, during gestation but the number of animals involved was limited. However, the results indicated that every-third-day feeding reduced sow weight gain compared to daily feeding when total feed intake was the same. Also, there was some evidence of reduced litter size and weight at weaning from every-third-day feeding. Michel et al. (1980) used 225 gilts to study frequency of feeding during gestation on reproductive performance of gilts and sows. In this two-parity study the 12% crude protein, fortified corn-soybean meal diet was individually fed once daily at a level of 1.9 kg or 5.7 kg every-third-day from day 30 to day 109 gestation. During the 28-day lactation period a 16% crude protein corn-soybean meal diet was provided ad libitum. Between weaning and reinitiating the gestation treatments during the second parity each sow was fed 1.9 kg daily. Gilts fed every-third-day gained less during gestation and farrowed fewer, lighter-weight live pigs than did those fed daily. Lactation performance was not affected. Sows fed every-third-day tended to gain less during the second gestation, but reproductive performance was not affected (table 8). Mahan (1980) studied the effects of feeding either 1.82 kg daily or equivalent amounts twice weekly for three reproductive cycles. Gilt reproductive performance was reduced when diets were fed twice weekly but sow performance was not significantly affected by frequency of feeding. Williams et al. (1979) investigated whether frequency of feeding during gestation would affect carcass composition and thermostability of the newborn. Sows were fed a barley-soybean meal diet either twice daily (1 kg per feeding), once daily (2 kg) or on alternate days (4 kg). During the last third of the gestation period sows fed on alternate days had increased serum-free fatty acids and decreased serum glucose levels compared to the other two treat-

ments. However, pig birth weight, carcass lipid, liver glycogen and serum-free fatty acids were unaffected by the feeding treatment. Nor did gestation treatment affect the newborn pig's thermostability (table 9).

WEANING TO ESTRUS LEVEL

Methods of feeding and managing sows between weaning and breeding are many and varied. Some producers feel that depriving the newly-weaned sow of feed or water, or both, for a period of time, frequently one or two days, stimulates return to estrus and improves breeding efficiency. Others feel that moderate to high levels of feed immediately post-weaning will give best results.

In a New Zealand study (Shearer and Adam, 1973) sows at weaning were either fed 2.7 kg of feed daily or were fasted for 24 hours then fed 2.7 kg per day. Average number of days from weaning to estrus was 8.5 for controls, 13.1 for fasted. Fasted sows also had 2.8 fewer pigs per subsequent litter than did controls. Depriving the sows of feed for two days post weaning (Tribble and Orr, 1982) or for 0, 2, 3 or 4 days (Allrich et al., 1979) did not prove beneficial.

King (1974) found no beneficial effect from fasting the weaned sow and Varley and Cole (1976) reported the interval between weaning and rebreeding was not affected by feed level whether weaning was at 10 or 42 days.

Brammeier et al. (1980) evaluated level of feed and individual vs. group management of sows after weaning on interval to estrus. One hundred and six sows were fed either 1.8 kg once daily or ad libitum-fed a 12% crude protein corn-soybean meal diet immediately following 28- or 35-day lactation periods. Water was available at all times from nipple waterers. Ad libitum-fed sows consumed an average of 3.5 kg of diet per day, and gained 1 kg in weight between weaning and estrus, whereas the sows receiving 1.8 kg of diet per day lost an average of 4 kg. Neither number of days to onset of estrus nor percent of weaned sows showing estrus within ten days of weaning was affected by level of feeding. Number of total and live pigs subsequently farrowed were higher ($P<.05$) for the sows fed 1.8 kg per day than for the sows fed ad libitum from weaning to rebreeding. Percent of sows showing estrus within ten days was higher (86%) in the sows in individual stalls than in sows in groups of five or six (73%). The number of sows that had delayed estrus or were anestrous or returned to estrus after breeding was higher in the sows in groups than in the sows in individual stalls (17 vs. 9)(tables 10 and 11). Tribble and Orr (1982) found that sows fed 1.8 kg per day had a shorter interval to breeding and a higher conception rate than sows fed 3.6 kg per day. Also, subsequent litter size at birth was greater for the 1.8 kg per day sows. Brooks et al. (1975) had previously indicated that level of feed following weaning of multiparous sows had no effect. O'Grady and Hanrahan (1975) suggest that protein level fed during lactation affects weaning to mating interval. Reese et al. (1982) found that level of feeding during lactation also affected interval from weaning to first estrus.

It is obvious that several factors can affect the weaning to estrus interval, but research data does not support the practice of fasting newly-weaned sows.

SUMMARY

A variety of management and feeding programs for the breeding herd can result in efficient reproductive performance of gilts and sows. But basic to all high-performance herds are good husbandry, comfortable environments and adequate nutrition.

Quality and quantity of feeding during gestation should satisfy the needs for maintenance, maternal growth and embryo development in the gilts, for maintenance and embryo development in the sow. And in both, a small, and as yet not defined, reserve for buffering the stress of parturition and lactation. Gestation gains (maternal) of 35 kg for a gilt and 20 kg for a sow seem to be satisfactory. The levels of feed required to provide these gains will reflect the weight at breeding and the environment.

The feeding regimen during gestation can affect lactation performance of the dam and performance of the progeny. Both overfeeding and underfeeding during gestation are wasteful. Use of "moldy" feeds in diets for the breeding herd should be avoided.

Interval feeding (every-other-day or every-third-day) can be a successful labor-saving approach to feeding gestating animals. It is somewhat less feed-efficient than daily, controlled feeding. But regularity of feeding in an interval-feeding schedule is necessary to minimize animal stress.

More detailed, long-term studies of management and feeding of sows from weaning to estrus are needed. Research to date indicates that fasting for a day, or longer immediately post-weaning, cannot be expected to stimulate onset of estrus. The most appropriate feeding level has not been defined and will likely be influenced particularly by factors such as condition of sow at weaning, environment and whether animals are individually or group managed.

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Table 1. Effect of Gestation Feeding Level on Weight Gain and Pig Birth Weight

Feeding level per day, kg	Dig. energy, kcal/day	Gestation gain, kg		Pig birth wt., kg	
		Gilts	Sow	Gilt	Sow
.91	3000	20	10	1.19	1.12
1.36	4500	33	23	1.21	1.19
1.82	6000	46	35	1.23	1.24
2.27	7500	59	48	1.25	1.29
2.73	9000	71	60	1.28	1.34
Change/kg of feed		28	28	.05	.12

28 experiments, over 5000 litters. (From Henry and Etienne, 1978), cited by Cromwell, 1980.

Table 2. Effect of Dietary Additions of Alfalfa and Tallow on Sow Productivity

Gestation-Lactation[a]	Corn-soybean meal (C:S)		Alfalfa	
	C:S	Tallow	C:S	Tallow
No. of litters[b]	53	52	62	63
At farrow:				
Live pigs	10.8	11.6	11.8	11.3
Avg. wt., kg[b]	1.50	1.44	1.37	1.41
At 14 days:				
No. of pigs[b]	7.7	8.0	8.9	9.1
Avg. wt., kg	3.91	3.94	3.74	3.93

[a]Three reproductive cycles.
[b]Alfalfa effect ($P<.05$). (Pollmann et al., JAS 51:294, 1980).

Table 3. Comparison of Corn:Soybean Meal, Milo and Milo-Plus-Lysine Diets for Gestating and Lactating Gilts

Diet	C:SB	Milo	Milo-+-lysine
Lysine, %	.49	.27	.47
Number of gilts	19	16	16
Gestation daily gain, kg[a]	.44	.22	.23
Pigs per litter, avg.			
At birth			
Total	9.7	10.3	10.4
Live	9.2	9.4	9.7
Avg. live wt., kg	1.24	1.20	1.31
Lactation[b]			
Pigs weaned, avg.	8.1	8.8	9.4
Pig gain, kg*	2.55	1.84	2.06
Avg. daily sow feed, kg*	3.81	2.53	3.42
Avg. sow wt., chg., kg	-12.70	-17.90	-15.90

[a]Gain from start to day 100 of gestation. Fed approximately 2 kg per head per day.
[b]Pigs weaned at 14 days of age.
*$P<.05$.

Table 4. Quantity and Quality of Dietary Protein for Gestating Gilts[a]

Diet	Corn		
	Regular	Opaque-2	C-SB
Diet protein, %	8.8	9.7	12
No. of gilts			
Started	54	54	53
Farrowing, %	76	73	70
Gestation gain, kg[b]	36[d]	47	49
Pigs at farrow			
Total, avg.	8.7	8.8	8.8
Live, avg.	7.3	7.5	7.6
Avg. wt., kg	1.26	1.27	1.27
No. of pigs weaned[c]	6.2[d]	6.9	6.9
Lactation			
Wt. gain, avg., kg	4.5[d]	-.3[e]	-2.3
Diet intake, kg	80	79	81

[a]Adapted from Baker et al., 1970.

[b]From conception to day 109 of gestation.

[c]21 days.

[d]Different (P<.05) from other two treatments.

[e]Different (P<.05) from C-SB treatment.

Table 5. Effects of Metabolizable Energy Intake During Lactation on Sow and Pig Performance

Item	kcal ME per sow per day		
	8000	12000	16000
Sows			
No.	23	23	23
Lactation wt. change, kg[ab]	-25.7	-13.3	- 3.3
Lactation backfat change, mm[ab]	- 8.4	- 4.6	- 1.8
Percentage in estrus[c]			
<7 d	65.2	91.3	95.7
<14 d	73.9	95.7	100.0
<21 d	73.9	95.7	100.0
<70 d	82.6	95.7	100.0
Pigs			
Avg. litter size at weaning, no.[a]	8.9	8.9	8.6
Avg. pig weaning wt., kg[a]	6.6	6.7	7.0

[a]Least-squares means.

[b]Linear effect of energy intake (P<.01).

[c]Difference among energy levels significant (P<.05) for all time periods.

Table 6. Lactation Dietary Fat and Pig Performance[a]

Diet	Starch	Oleinite	Safflower oil
No. of sows	34	34	34
Average weight, kg	214	203	200
Weight change, 21 days, kg	-.6	2.0	5.1
Daily feed intake, kg	5.8	5.5	5.6
No. of pigs at birth	9.8	10.8	10.3
No. of pigs at 21 days	8.2	9.1	8.3
Average weight, kg			
Birth	1.4	1.3	1.3
21 days	6.0	4.7	6.1

[a]Adapted from Stahly et al., 1980.

Table 7. Dietary Protein Levels During Gestation and Lactation and Sow and Pig Performance[a]

	Lactation diet protein, %		
Item	12	16	20
No. of live pigs at birth, avg.	9.1	8.7	9.1
No. of pigs at 14 days	7.6	7.4	7.5
Avg. pig weight, 14 days, kg			
9% gestation diet	3.5	3.8	3.8
15% gestation diet	3.8	3.8	3.9

[a]Adapted from Frobish (NCR-42 Committee on Swine Nutrition, 1978).

Table 8. Effects of Interval Feeding During Gestation on Reproductive Performance

Item	Parity			
	First		Second	
	ED[b]	E3D[b]	ED	E3D
No. of sows[c]	80	81	45	48
Gestation gain, kg[d,e]	39	30	26	22
Pigs at farrow				
Total, avg.	10.7	10.7	11.3	11.3
Live, avg.	9.7	9.4	10.4	10.5
Avg. wt., kg	1.4	1.3	1.6	1.5
Pigs at 28 days				
Per litter	8.4	8.0	9.1	8.7
Pig wt., avg. kg	6.2	6.0	6.7	7.0

[a]Adapted from Michel et al., 1980.

[b]Ed = every-day feeding; E3D = every-third-day feeding.

[c]Average weight at breeding, 148 and 175 kg for gilts and sows, respectively.

[d]From day 30 to day 109 of gestation.

[e]Differences between gilts ($P<.05$); difference between sows not significant.

Table 9. Effects of Feeding Once or Twice Daily or on Alternate Days During Gestation[a]

Item	Feeding regimen		
	Once daily[b]	Twice daily[c]	Alternate days[d]
No. of sows	9	10	10
At farrow			
No. of pigs, avg.	10	11	9
Avg. weight, kg	1.13	1.08	1.08
Avg. carcass lipid, %	1.14	1.14	1.12
Liver glycogen, g/100 g wet tissue	11.26	12.48	12.83

[a]Adapted from Williams et al., 1979.

[b]2 kg.

[c]1 kg at 12-hour intervals.

[d]4 kg at 48-hour intervals.

Table 10. Effects of Feeding Level and Management Post-Weaning on Sow Weight Change and Days to Estrus

Feeding method	No. of sows	Sow weaning wt. kg	Wt. change to estrus kg	Feed per sow per day, kg	Days to estrus	Percent of sows in estrus by 10 days
Ad libitum						
Group	19	164	+3.2	4.1	5.1	74
Individual	22	159	-0.9	3.1[b]	5.2	91
Avg.		162	+1.0[a]	3.5[b]	5.2	83
1.8 kg per sow per day						
Group	18	173(168)[c]	-5.0(-0.8)	1.8(2.9)	4.9(5.0)	72(73)
Individual	21	159(159)	-3.2(-2.0)	1.8(2.4)	5.0(5.1)	81(86)
Avg.		165	-4.0	1.8	4.9	77

[a]Weight change differed significantly (P<.05) between ad libitum-fed and restricted-fed sows.

[b]Ad libitum-fed sows consumed more (P<.01) feed per day than did the sows fed 1.8 kg per day. Also, among the ad libitum-fed sows, those in groups averaged more (P<.01) feed per sow per day than did the sows in individual stalls.

[c]Values in parentheses are averages for group and individual management.

Table 11. Effects of Feeding Level and Management Post-Weaning on Performance Subsequent to Breeding

Feeding method	No. of sows	Gestation weight change, kg		Number of pigs		
				At farrow		Weaned
		0 to 25 days	25 to 50 days	Total	Live	
Ad libitum						
Group	19	3.4	4.0	10.3	9.7	7.9
Individual	22	8.1	4.2	8.9	8.7	8.0
Avg.		5.9	4.1	9.5	9.2	7.9
1.8 kg per sow per day						
Group	18	3.1(3.2)[a]	4.7(4.3)	11.1(10.7)	10.3(10.0)	7.6(7.7)
Individual	21	4.4(6.3)	3.9(4.0)	11.3(10.1)	10.4(9.5)	7.9(7.9)
Avg.		3.8	4.3	11.2[b]	10.3[b]	7.7

[a]Values in parentheses are averages for group and individual management.

[b]Number of total and live pigs farrowed were higher (P<.05) for the sows fed 1.8 kg per day from weaning to breeding than for sows fed ad libitum.

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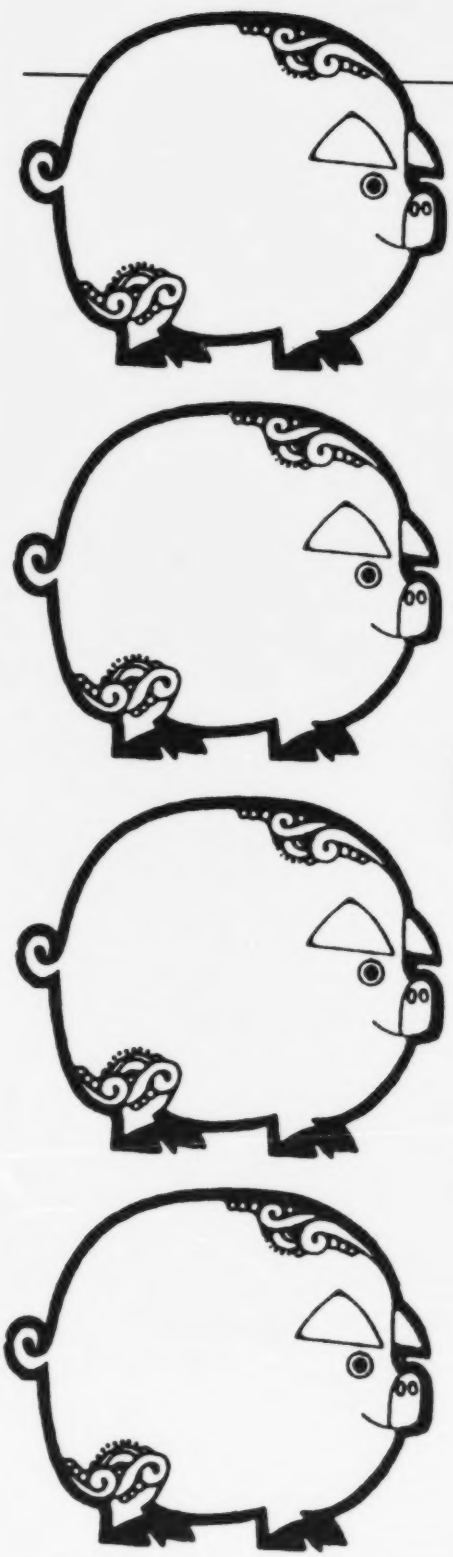
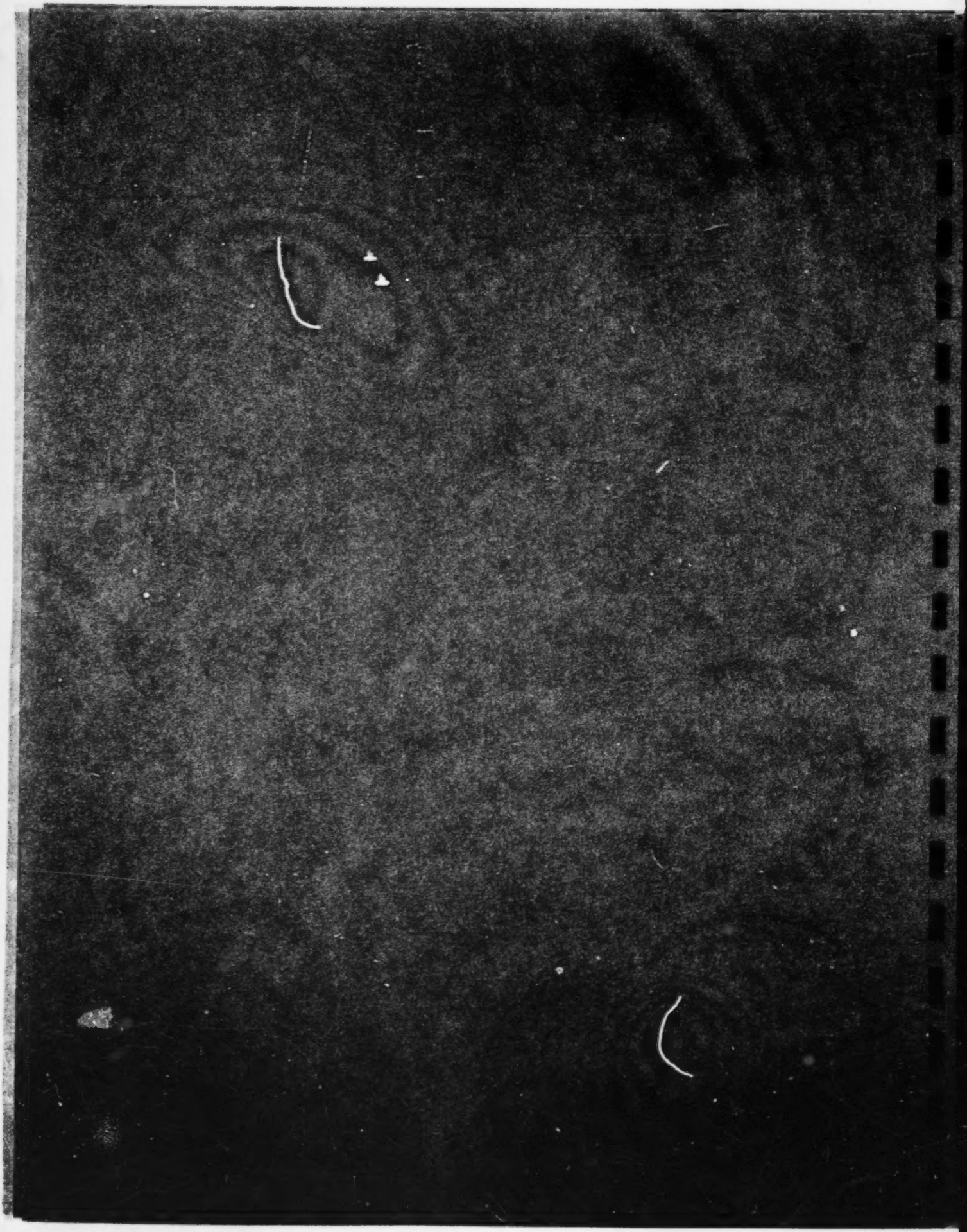


Hog Day '82



Sow Psychology and Rebreeding Barn Designs

D. Kleinsasser, Swine Manager
Crystal Springs Hutterite Colony, Ste. Agathe, Man.

The topic of this presentation is "The Psychology of the Sow" - her behaviour and more important yet, her requirements. We will discuss the sow's requirements for producing to her fullest potential at her most efficient rate. Once we have established her requirements, we will demonstrate how to accommodate those requirements in terms of floor layout and equipment.

My concern in this presentation is going to be more on handling and accommodating the sow after weaning, or how to get those sows bred and in pig. Our aim is to do this in the least possible time, with the least amount of work and still get the best possible results. The criterion used to evaluate our results is the amount of time any sow spends empty or non-pregnant.

Two very important factors of efficiency in the barn are more than adequately being covered by two excellent speakers. Clarence Froese presents record keeping systems, without which it is impossible to run an efficient operation. Dr. Jensen presents the nutritional aspect, without which it is also impossible to be efficient.

In order to avoid duplication, I will assume that you already have good records and I will also assume that the sow nutrition is taken care of, and go on from there.

Therefore, to start off, let's name the sow's requirements from weaning to farrowing, in that order, and then go back and elaborate on each of these items and specific requirements.

Assuming we have now weaned the sow, the requirements for successful rebreeding are:

1. Stimulation
2. Heat Detection
3. Breeding
4. Holding Bred Sows
5. *Holding Gestation Sows*

Let's now elaborate on each of these five listed requirements.

1. Stimulation

Optimum performance is obtained when a sow returns to estrus in four to seven days after weaning, with a first-litter sow being a little more unpredictable, at about six to fourteen days. This is about the best we can achieve, so let's call that our goal. If this goal cannot be achieved, one of the first things that could be lacking is proper stimulation. The emphasis here should be on light and boar contact, the stimulus with boar contact being boar odor and boar sounds.

It has been demonstrated fairly conclusively by researchers that the two stimuli just mentioned have a direct effect on speeding up return to estrus after weaning by as much as three to four days.

Light

University of Guelph research by Dr. R.R. Hacker demonstrated that gilts maintained under a long photo period, (that is, 14 to 16 hours of light per day) came into puberty earlier than gilts exposed to little or no light.

Gilts raised in darkness reached puberty 40 days later than gilts exposed to a 12 hour day length. Also, sows weaned into a 16 hour day length return to estrus much sooner than sows weaned into darkness or short day length.

There seems to be no benefit in extending beyong a 14 to 16 hour day length. The same research concludes that there is no benefit in daylight or ultra-violet light over regular cool-white light, which is by far the cheapest to install.

Light intensity should be between 15 to 20 foot candles (metric equivalent equals 150 to 200 lux). In an area of 15 ft. wide and 8 ft. high, a single row of fluorescent bulbs, directly above the pigs will supply 15 ft. candles or 150 lux. Aside from additional electricity costs, there is no harm done in exceeding those figures to be on the safe side for maximum stimulation.

Boar odor and boar sound

Some very conclusive research by Purdue University shows that boar contact is even more important than light. This is illustrated in Table 1.

Table 1. The effect of supplemental lighting and boar exposure on puberty in gilts.

	Gilts Attaining Puberty by 8 Months	
	Supplemental Light	No Supplemental Light
Boar Exposure	76.9%	78.6%
No Boar Exposure	13.3%	30.8%

M. Diekman, Purdue University, 1981

This test shows fairly conclusively that boar contact is more important than light. From this test, one can also conclude without doubt, that removing both light and boar exposure is disastrous.

Open pens for breeding and 21 day holding pens should be constructed so that there is good physical and visual contact between sows and boars. Barred, see-through pens are best. Realizing these facts, one can only conclude that stimulation is a very important requirement in an efficient sow barn.

2. Heat Detection

Stimulation without heat detection by the operator is useless for a simple reason. It is the operator who has to move the sow to the boar, or vice-versa. Here again, there are many tricks and methods an operator can use as tools for better heat detection. I will endeavour to list as many as I can think of, and also the ones we use in our own operation.

Feeding time

Many operators feed and breed sows in the morning. In my opinion, this is wrong. Sows are very exact in knowing when their routine feeding time is. If feeding is usually done in the morning, the operator opens the door, enters, pushes the feed cart or just walks around. All sows and boars get up and expect

feed. No reasonable heat detection or breeding can occur when sows and boars are expecting feed. Under restricted feeding programs, the urge to eat is greater than the urge to mate. You're better off not even trying to detect heat when the situation is such.

If feeding time is later in the afternoon, the sows do not expect feed when the operator enters in the morning, nor do they bother to get up. Here we have a situation that is favorable to heat detection and breeding. Firstly, the urge to mate is not counteracted by hunger. Secondly, any pen of females that is up and restless usually indicates a sow in heat, or at least in the first stage of estrus. She should be checked out with a boar.

Sow grouping

Another tool that can aid heat detection in sows that are held for a 21 day repeat check is grouping. At least 90 percent of the sows will jump other sows when in heat, if given the chance. This is an excellent visual sign to the operator that a sow is in heat.

To avoid excessive fighting, there should never be more than two to three sows in a group. Two or three sows in a pen seem to adapt themselves very easily to one another, without excessive fighting, compared to larger groups.

Post-mortem examinations by veterinarians of so called non-productive repeat sows have shown that only about ten percent of such sows showed signs of physical defects that rendered these animals incapable of breeding or conceiving. I would personally bet any amount that the rest of the sows which many of us ship as empty at pregnancy-checking are perfectly normal sows and cycle every 21 days. Probably the only problem with them is that the operator did not detect heat, just did not notice them jumping, or that the sow was a "non-jumper" or silent heat type.

Another reason for an empty sow might be that she was bred too early or too late in her estrus cycle. One then wonders who should be shipped, the sow or the operator. Some of the blame can be put on poor barn design.

3. Breeding

In this area, one of the main concerns should be to minimize manoeuvering of the sow or boar. Sows to be bred should always be placed right next to the boar that is to be used. Too often there are times when we put off bringing a sow that is jumping to the boar because she is a hundred feet away. If we only had to open a gate to get that sow to the boar, we would do it right away.

Observation

Ease of observation of breeding pens should definitely be considered as important.

Slippage

Another important item is slippage when mating. Both the sow and boar often suffer permanent physical damage by slipping when breeding on wet slippery floors.

Dry floors

Cement floors should be roughened when poured. Pens should be scraped daily to free them of manure so that the floor remains reasonably dry for breeding. Keeping a pail of cheap limestone handy and throwing a few handfulls under the sow and boar works quite well.

All-slat floors

An all-slatted floor works best. Concrete slats with 3/4 inch hand troweled pencil round edges on the slot seem to work fairly well. The reason for the narrow 3/4 inch slot is that animals get damaged by wider slots when breeding. Even the narrow slot will damage an odd one. Sow sized rubber coated expanded metal type flooring seems to show a lot of promise lately, and seems to alleviate this problem.

4. Holding Sows For 21-Day Repeat Check

Finding repeats

This works best when sows are placed in pens of three or four sows for four weeks. There is much less fighting in small groups. Sow holding pens should be

very close to breeding pens to stimulate repeat sows to jump and show themselves to the operator. Ideally, one would like to put the bred sows into stalls immediately. There are a lot of operators who do just that; but there are weaknesses in this practice. The weakness of putting bred sows directly into the stalls is this. You have taken away the chance for the operator to visually detect heat in the 90 percent of the repeat sows that normally jump other sows, if given the chance. Consequently, repeat sows can usually be found only with a pregnancy-check machine at 28 to 30 days, therefore missing a heat cycle. A missed cycle costs the average operator $35.

5. Holding Gestation Sows For Proper Weight Control

Full-fed sows

Research shows a faster return to estrus and better ovulation on full-fed weaned sows. At breeding and during the three week holding period for the repeat check, feed should not be overly restricted, because most sows need to regain weight lost in the farrowing crates.

Restricted feeding

After pregnancy is confirmed, sows should be placed in stalls and put under exact feed intake control to avoid excessive weight gain. Overfat sows tend to have more farrowing problems. One can get extra life and litters out of a sow that is kept slim.

Sows in stalls

Researcn shows that sows in stalls versus sows in pens or running outside come up with almost one pig more per litter. Piglets born to stall sows are significantly heavier at birth.

The reason for the extra pig can probably be contributed to fewer embryo losses. Most embryo losses are caused by the stress of fighting and crowding in open sow pens housing large numbers. Some of the credit for heavier birth weights can go to the decreased stress in stalls. Exact feed intake control and restriction of the activity and physical movement of the sow in a stall, also contribute to heavier birth weights.

The following blueprints show three alternate floor layouts or plans. These more than adequately accommodate the sow requirements which have been discussed at length.

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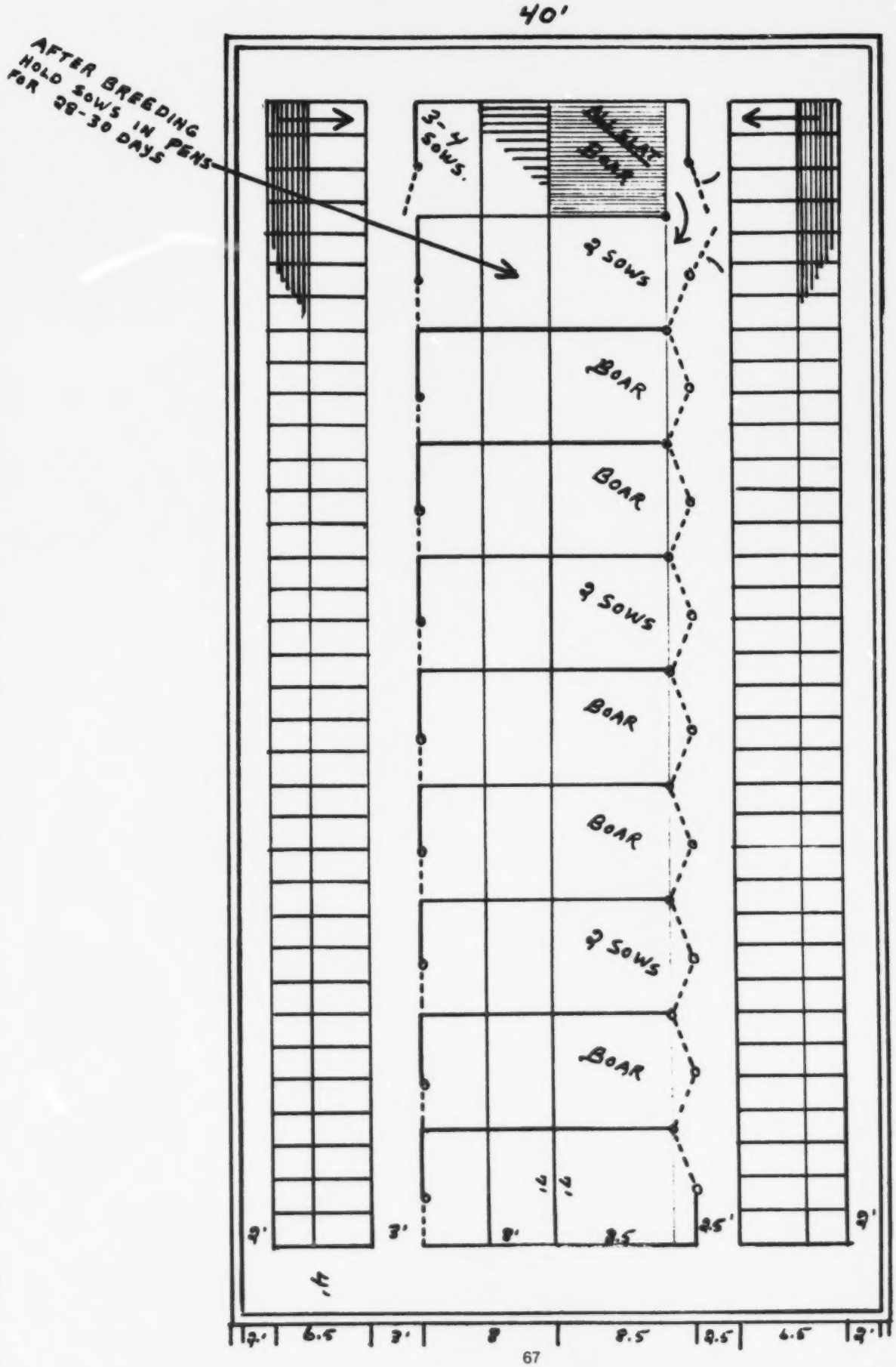
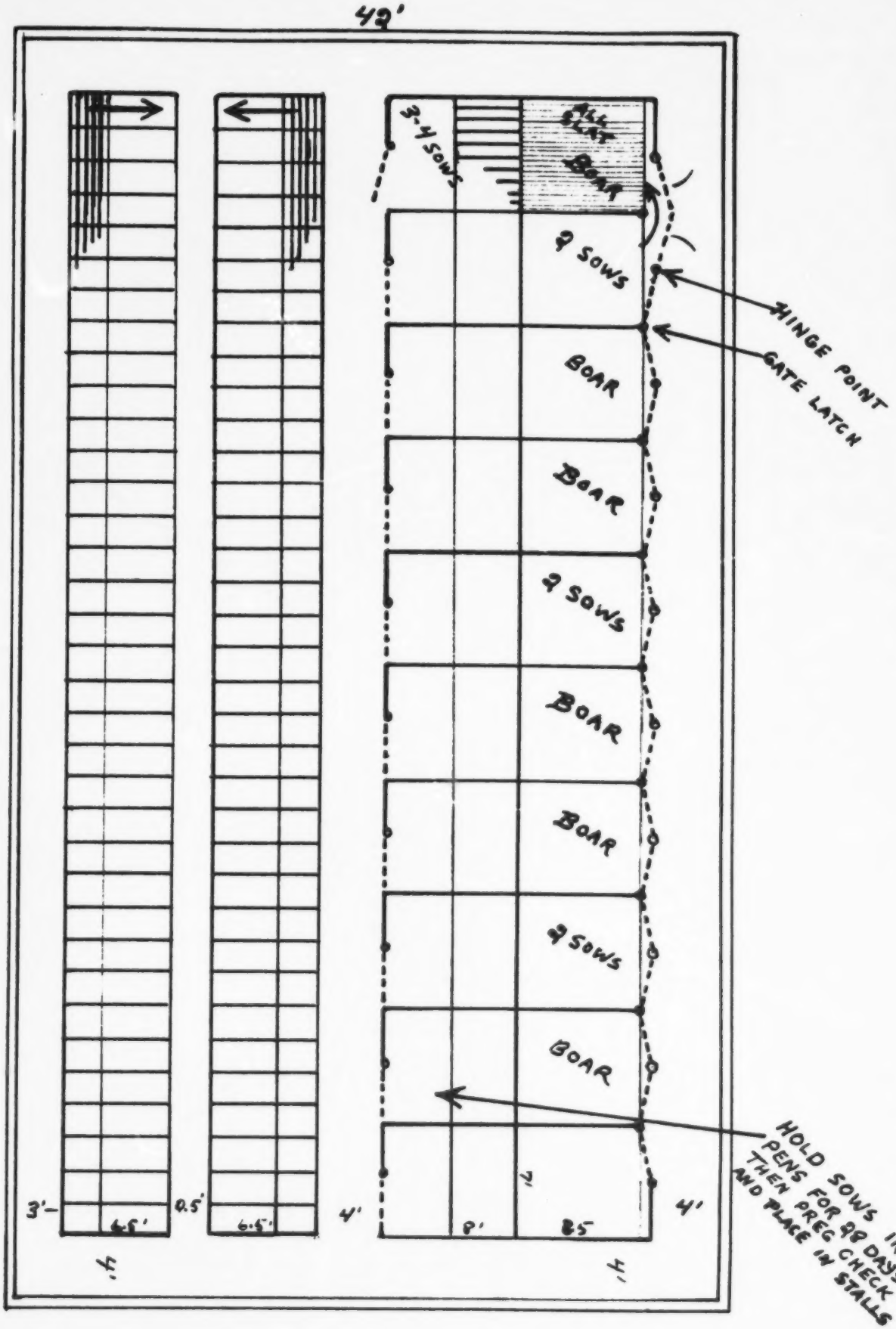
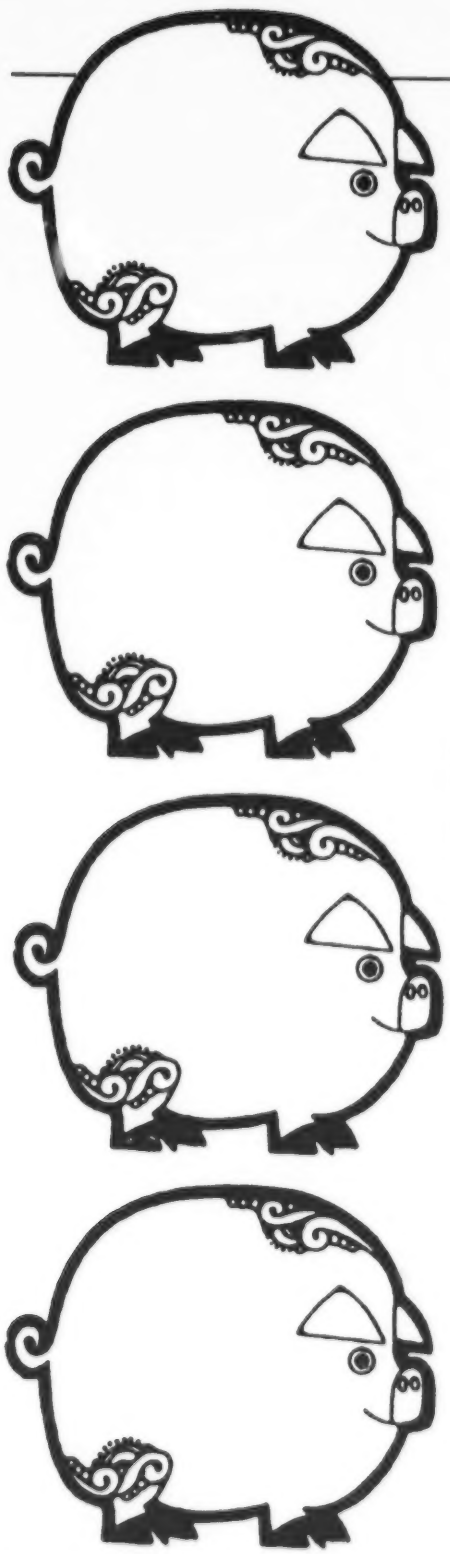

40'
AFTER BREEDING
HOLD SOWS IN PENS
FOR 28-30 DAYS
3-4 SOWS.
SLAT
BOAR
2 SOWS
BOAR
BOAR
2 SOWS
BOAR
BOAR
2 SOWS
BOAR
7'
7'
2'
3'
8'
8.5
25'
2'
4'
2'
6.5
3'
8
8.5
2.5
6.5
2'


42'
3-4 SOWS
ALL FLAT BOAR
9 SOWS
BOAR
BOAR
9 SOWS
BOAR
BOAR
9 SOWS
BOAR
HINGE POINT
GATE LATCH
HOLD SOWS IN PENS FOR 28 DAYS THEN PREG CHECK AND PLACE IN STALLS
3'
6.5'
0.5'
6.5'
4'
8'
8.5'
4'
4'
4'

48'ft

144 sq ft



Hog Day '82

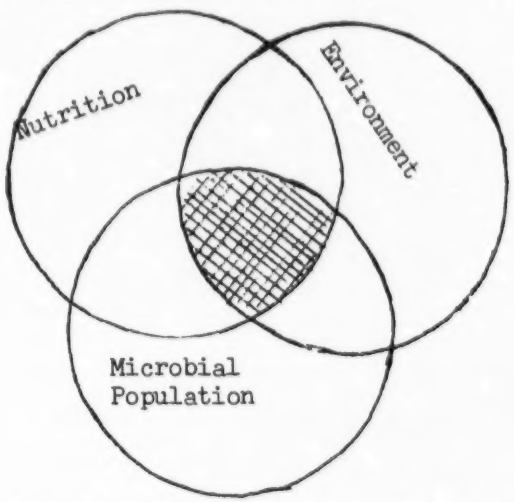
Feeder Pig Management

Dr. Camille Moore

I have been asked to talk to you about "FEEDER PIG MANAGEMENT", it is a very large subject, we could discuss it for a week without going through all its different points. I believe that when we want to approach this subject like every pork production point, we have to go back to the basics, try to think like a pig. Be practical, "Be basic."

In the past few years, we used to take piglets as small as we could, from many different sow barns, keep as many as we could in the same barn which has been designed for the convenience of the pigman not for the pigs, to feed them according to the schedule of the pigman, to give them the cheapest feed on the market, to look after them only when we feel like it and even then still expecting good results. I sincerely think that this time is over, and that we should go back to basics "Be basic".

The following diagram can be used to sum up feeder pig production, and especially its production efficiency.



A perfect mix of nutrition, environment and ambient micro organisms will give you a high production return from feeder pigs. To get a perfect balance of these three components, you have to go back to the base; "BE BASIC".

In a few minutes, we will discuss "Feeder Pig Management", we will look more closely on the following subjects: water, air, feeding, housing, typical management procedures disease control and finally, record keeping.

WATER

Water is the basic feed of all the mammals and constitute more than 80% of pig's body weight. Too often, I receive a call from a producer who wants good feed mix because his pigs are not doing well but are not sick. So, I go there, check everything and the only problem that I can see, is a lack of water. So think, about it, do you really need to pay a veterinarian for such a basic thing. "Be Basic".

The first point about water is its quality. Every good producer should get his water analysed (to know its components) before starting his production. Would you buy feed without asking about its protein, its energy, its components? So, why aren't you as conscientious as that for your water? "Be Basic".

The second point about water is its quantity. There are many theorical figures concerning water consumption. I would believe that the two most useful are: a pig needs a gallon of water per 100 pounds of body weight or a pig should drink three pounds of water per pound of feed. Most of the producers have enough water to meet these requirements but in many cases pigs are unable to get the water. Here are some examples: we feed all the animals at the same time so, they need water all at the same moment, the water pipes are plugged up by rust and are calcareous; we use a water medicator which results in a lower pressure... Get practical. "Be Basic".

Finally, the last point is the drinking facilities. There are many ways to give water to pigs; through, drinking nipples, wet feed, each of them presenting its own advantage and disadvantages. Personnally I prefer drinking nipples. Nevertheless, whatever your drinking facilities are going to be, don't forget the following points: there should be

enough drinking troughs for your batch of pigs. (1 drinking nipple for 50 pigs is surely not enough), the flow and the operation of your drinking trough should be checked every day, you should keep the drinking areas clean, (even if we deal with pigs, if they drink treponema all day long do not be surprised if your pigs get bloody scours). Everybody knows that pigs are not bright, if you have pigs of 35 pounds, and you have a drinking nipple at 30 inches from the ground, even if you do your best, and install stairs below and a one way sign indicating the drinking nipples place, it is not a guarantee that the pig will find it. "Be Basic."

AIR

Oxygen is a vital necessity. Our housing facilities need an artificial ventilation. There are a lot of varieties on the market. All these systems have their advantages and disadvantages but we won't discuss it here today.

Basically, the purpose of a ventilation system is to supply enough oxygen, eliminate harmful gas and control humidity and temperature. To be operational a ventilation system has to be completed with sufficient insulation and a good heat source. You should keep the temperature of your feeder barn at 72°F for pigs between 30 to 75 pounds, at 69 to 70°F for pigs of 75 to 150 pounds and at 65°F for pigs over 150 pounds. You should keep humidity between 50 and 60%.

The major problems concerning ventilation are not in the technical facilities but in the way to use it. Accordingly, most of our modern barns, have enough fans and air inlets, however:
-the producer does not open his air inlets enough when the fans are operating which results in a vacuum in the barn.
-he lets the wrong fans run and so creates airstreams.
-in winter time, to save energy he completely shut the air inlet which results in a lack of oxygen.

-or simply, the fans are so dirty that their efficiency is reduced by half.

People, there again you have to be practical. "Be Basic".

FEEDING

Feeds represents around 60% of our production cost. It's certainly the area in which you have to concentrate your efforts to make your business profitable. At an average price of .80¢ per pound, each tenth of feed conversion saved, brings your profits up for $1.50 to $2.00 per pig. For example, a producer who puts on the market 2,000 pigs a year and reduces his feed conversion from 3.8 to 3.6 can save $3,000 to $4,000 a year. Which is quite interesting.

Now, I am quite sure that the question you have in mind is "How to do it? (That's the question).

For sure, the use of high energy feed or special products can improve your feed conversion. Now, let's see what can be done basically to improve your conversion.

Wasting is certainly the major reason of a bad feed conversion. Every week, going to a barn, I could easily pick up in a pen of 20 pigs, around 50 pounds of feed on the ground. So, if you got 50 pens like this one in a barn, it means enough feed to produce three pigs. It doesn't matter what feeding system you are using, always watch for waste. If you have self-feeders or automatic feeders, check their adjustment every day. Don't let the feed sit on the ground for a long period of time because, it will loose of its quality, take the smell of the barn and, the pigs will refuse to eat it. Even more, this protein left on the ground get moulded and become a good agar for the micro organisma growth; so many bloody scours

problems begin there. If you're doing hand feeding, the younger the pigs are, the more often you should feed them, and when they get older (135 pounds and over), you should not be able to find any feed on the ground.

Concerning the type of feeding to be used, it has been proved for a long time that between 30 and 75 pounds, a pig needs 18% protein ration, between 75 and 150 pounds 16% and over 150 pounds 14%. Don't raise your protein level for nothing, it won't increase your return.

Every day, there's gonna be a salesman at your door to offer you "the feeding additive". For sure, the use of feeds additives for disease prevention in your starter rations and as growth stimulant for your grower and finisher rations, will increase your return. These additives should be chosen regarding its cost, its effectiveness, and the problems you have to deal with in your barn. Ask your veterinarian who can easily help you in these matters. However, don't forget, even if you're using the most appropriate feed additive, if you loose a great part of it in the pit, you won't make any profit. "Be Basic".

HOUSING

If somebody here intends to build a new barn, I would like to spend a little time with him trying convince him to build a barn made of many small sections to be able to operate all in all out. For a sow barn or a feeder barn, we should not build large buildings for the purpose of saving on construction costs. Concerning the feeder barn, the economy made in reducing the disease and lowering the feed conversion will, on a long term basis, pay you back many times.

It is sure that I don't recommend burning your old facilities and building a new one. You'll have to get along with what you already have! On the other hand, if you can't do all the basics things that I have previously discussed, you should quickly modify your facilities. In addition, your barn should present a good manure handling system and be properly insulated you will save on energy bills with proper insulation. "Be Basic".

Concerning the quantity of pigs to be housed, there is a lot of data

on this subject but, be sure that a crowded barn won't make profit. According to my point of view, I would recommend a partly-slatted floor (a complete slatted floor should never be built) a five square feet per pig of 75 pounds and below, 7' to 150 pounds and 9' to market weight. At first glance, it seems too much but try it and you'll see a difference.

If you buy your piglets from different places, you should have a quarantine. It's a place outside your principal barn where you can put your new piglets for a period of 2 or 3 weeks and check them. This is also the place where you can deworm them and give them preventive medication. Your investment is too important and there are too many diseases to take a risk of contamination by introducing new subjects directly in your barn.

The last point that I will talk about concerning housing is the sanitation. It is useless to talk about disease prevention and good productivity of you don't take time to clean and disinfect your pens properly between each group of animals. You have to decrease the microbial poplulation. Be realistic, a brush and disinfectant are much cheaper than antibiotics. "Be Basic".

TYPICAL MANAGEMENT PROCEDURE

There is a different management procedure for each specific situation. However, it is possible to trace some general lines which can be useful for everbody. Necessarily, all management procedures have to apply all the recommendations described before about water, air, feeding and housing.

The following recommendations have been prepared for a feeder who buys piglets from different places. You will understand that if you are producing your own piglets, some points are not for you. Generally, we should:

-Isolate new piglets for a 2 week period for the purpose of observing them and give them useful prevention treatment.

-Give them an injection of long acting antibiotics on their arrival (or even better at their departure from the sale barn).

This precaution is very profitable especially if the piglets are exposed to a long journey.

-Be sure that you new piglets weight at least 30 pounds, have been castrated (the wound properly healed) and whose tail has been cut.

-Supplement water with some electrolytes and vitamins for a 5 day period after arrival will help the piglets to pass through this stress period. I sincerely believe that it is not useful to add antibiotics in water, unless you deal with a very specific problem.

-Restict feed intake for few days to permit to the piglets' stomach to get used to its new feed.

-Classify the piglets according to their weight and put together the sick and weak ones. In fact, you should continually take out the sick or poor pigs and place them in a "hospital" pen.

-Record everything you do (classification, treatment) to your piglets and put a mark on each piglets treated to be able to follow its progress.

-Mixing pigs is not recommended because everytime you do it, you change the social order and then you will have fighting, less feed consumption and a slow growth rate. If you have to mix them, be sure to oil them; this will prevent fighting.

-Treat your pigs adequately against internal and external parasites. Highly infected pigs with mange and lice could represent a lost of $0.50 to $1.00 per head it market weight. An oil treatment with acaricide has to be administered as soon as possible after their arrival followed by a second treatment 10 to 12 days later. For internal parasites, the loss could be greater if they are not treated adequately. There are many ways of demorning a pig; in its feed, in its water, or by an injection. All these treatments have their advantages and their disadvantage, but are all effective. You have to judge the cost and the application facility in the specific barn. If you use "hygromix", use it for the proper period or if you use a vermifuge, treat them a week after they came in and repeat the dosage 6 weeks later (or do an EPG). Read carefully the label and do not hesitate to contact your veterinarian for the procedure. It is useless to put your money in a deworming program

if you are not doing it properly. "Be Basic".

DISEASE CONTROL

Talking about disease, there is nothing easy. A disease outbreak is associated with unbalanced nutrition, environment and "microbial population". You always have to distinguish between acute and chronic pathological problems.

If you deal with an acute disease outbreak, it is very important to have an exact diagnosis before instituting any treatment. If you see some bloody scours in your pen, you can be confronted with vibriosis, salemonellosis, coli infection, campilobacter infection, stomach ulcer, canibalism or simple rhinitis. According to your specific condition, the treatment will differ considerably. Get a proper diagnosis. "Be Basic".

For a chronic disease, the biggest mistake you can do is to use a ton of antibiotics without knowing your real problem. You would only spend your money and develop antibiotic resistance. Once again, with a chronic disease you need a specific diagnasis. For that, do not hesitate to consult your veterinarian, to invest money in lab work, to have some slaughterhouse check done, improve your sanitation program and genetics....

Before putting an end to disease control, I would like to talk to you about drug resides in meat. It is time to stop being afraid of being caught if we put on the market some animals which have been previously treated with drugs. We should not try to find some ways to get around law. We will have to get used to following every part cited by the law. If we do not change out actual habits, we will lose our market and at the same time lose the privillage of medication facilities, which with proper use, is very useful.

RECORD KEEPING

At the end of your fiscal year, when you want to know the viability of your operation, you just have to add all your income and expense you

you will then have your results. To get there, you certainly have gone through a completely compatable system. But, if I ask you what was your feed conversion last year, would you be able to give me an answer or at least, do you have the proper figures to count it?

Record keeping is very important because, it shows you the return a good or a bad one, of your operation.

Your record for a feeder barn should show; the date of piglets arrival, their origin, the quantity, their weight, their age, all the transfers or pigs; all the treatments received, their length and cost; the feed consumed; the age and weight at slaughterhouse; condemnation certificates; the mortality. With all these figures, you will be able to evaluate your real productivity. Do not trust appearances. "Be Basic".